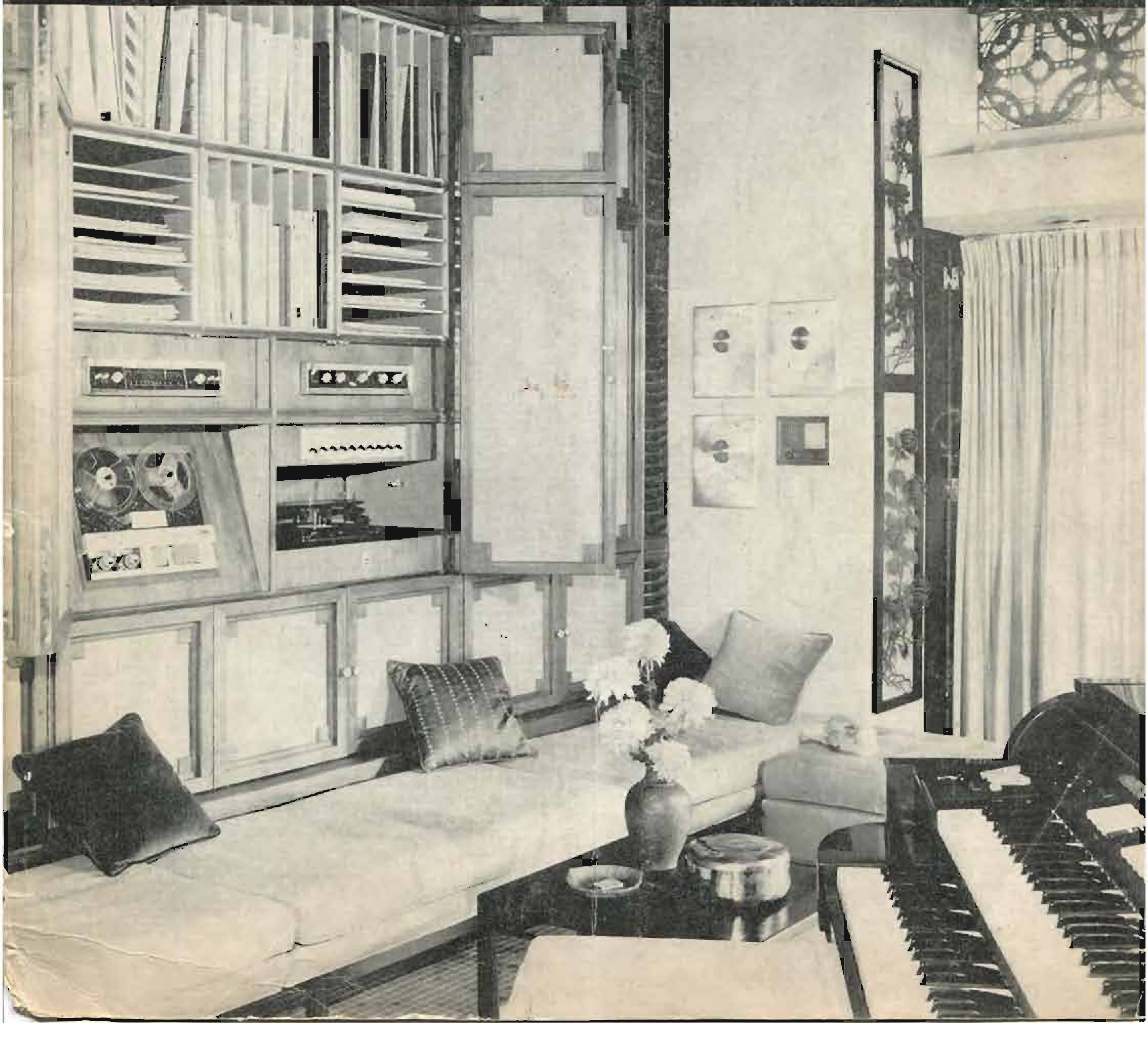
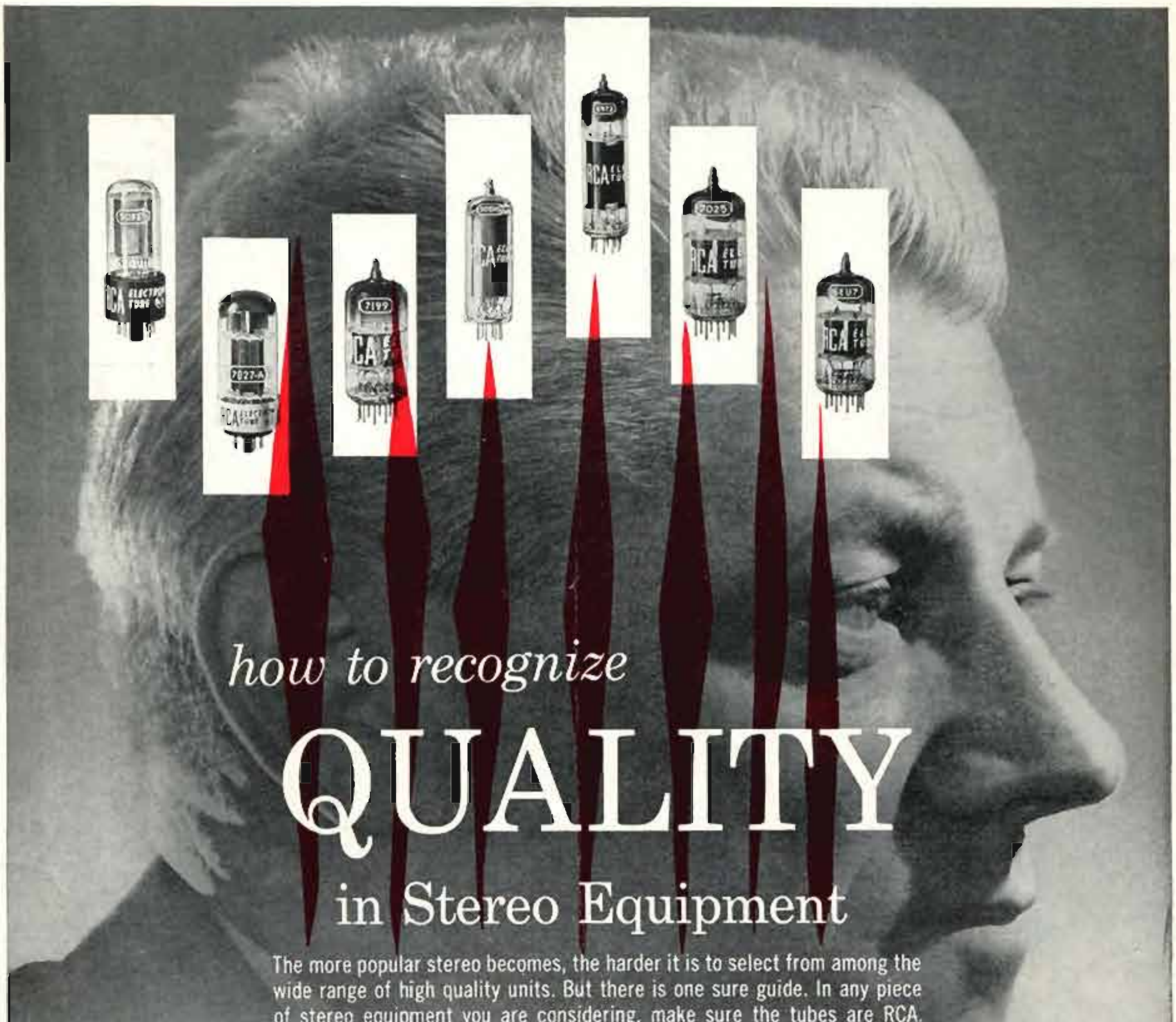
AUDIO

SEPTEMBER, 1961
50¢

...the original magazine about high fidelity!





how to recognize

QUALITY

in Stereo Equipment

The more popular stereo becomes, the harder it is to select from among the wide range of high quality units. But there is one sure guide. In any piece of stereo equipment you are considering, make sure the tubes are RCA.

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Two superlative low-noise high-mu twin triodes:

RCA-7025—the tops in preamplifier tubes. Specially designed with new materials and short, rugged cage structure for low noise, hum, and microphonics.

RCA-6EU7—excellent performance with low noise in preamplifier stages. New base pin arrangement facilitates design of a stereo preamplifier using the two triode units with good isolation between the two channels.

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RCA-6973—compact, powerful 9-pin miniature beam power tube. Four 6973's in class AB_1 push-pull service can deliver up to 24 watts per stereo channel (or 48 watts monophonic) with total harmonic distortion of only 2%.

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SEPTEMBER, 1961 Vol. 45, No 9

Successor to RADIO, Est. 1917

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FM MULTIPLEX STEREO BROADCAST MAKES HISTORY

CHICAGO, Ill.—Station WKFM made the world's first FM stereo multiplex broadcast simultaneous with their usual background music programming. Equipment used was designed, constructed, and installed by Sherwood Electronic Laboratories. Another World's "first" was achieved by Sherwood's sponsoring the FM Stereocast.

Edward S. Miller, Gen. Mgr. of Sherwood cues Frank Kovas, WKFM Pres., to start the pioneer stereocast.

PRESS PARTY

Gathered at the Gaslight Club in Chicago were members of the electronics industry and the press. The Stereo Multiplex broadcast was received via the new Sherwood S-8000 FM/MX Stereo Receiver—the first such unit on the market.

John Radtke, Sherwood's Chief Research Engineer, checks out WKFM's stereo multiplex transmitting equipment.

Sherwood's Bud Fields and Jerry Fields of Musi-Craft enjoy the first stereocast over Sherwood's new S-8000 64-watt Stereo FM Receiver.

Reporters from electronics publications enjoyed the change of pace at Chicago's Gaslight Club.

For details on the S-8000 or versatile Stereo MX adapters write Sherwood Electronic Laboratories, Inc., 4300 N. California Avenue, Chicago 18, Illinois. Dept. 9A.

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A proud new achievement! For pure playback of 2 and 4 track stereo and monaural tapes. Superb frequency response. Installs in hi-fi systems. Has facilities for adding erase and record heads; 2 outputs for plug-in preamplifiers. Adaptable for language lab and industrial use.

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AUDIO clinic

JOSEPH GIOVANELLI*

Note—

The volume of correspondence handled by this column is increasing constantly. Therefore, if any of you find that an answer is not forthcoming with the speed of reply to which you are accustomed, you will understand why this is so.

In order for me to work as quickly as possible with no sacrifice in the completeness of the answers to your questions, I look for ways which make it mechanically easier for me to get the work out. May I enlist your cooperation? You can help by including your address in the body of the letter in addition to its being provided on the self-addressed, stamped envelope you enclose with your letter.
Thanks a lot.

Tape Copying

Q. Please tell me how to reproduce quality tapes from an original tape. I have been making good originals on a semi-professional machine and have been trying to copy these directly on a home tape recorder. Regardless of which machine is used to copy from, or to, neither way is acceptable on playback. Russel B. Maxey, Columbia, S.C.

A. If it is possible for you to do so, I suggest that you measure the frequency responses of both machines. The chances are good that the home machine will not have anywhere near the high-frequency response possessed by the semi-professional machine. Assuming that both machines do have good responses, there is still the possibility of high-frequency losses in the final dub. Let us assume, for example, that the semi-professional machine is down 3 db at 15,000 cps, and that the home machine is down 6 db at 15,000 cps. The original tape was made on the semi-professional machine. It is, therefore, down 3 db at 15,000 cps. When this tape is copied on the home machine, the signal at 15,000 cps is further attenuated. It is now down 9 db at this frequency. If you were using two semi-professional machines—same model—the response would be down 6 db at this point in the spectrum. This would represent a noticeable difference in sound quality to the ear, between the original and the dub.

Recording companies use equalizers to restore the lost highs. They introduce a rising characteristic into the dubbing process to offset the losses in the mastering machine, the playback machine, and the dub-copying machine. By this method, several generations of tape can be made without serious impairment of the highs. However, the signal-to-noise ratio is sacrificed to some extent.

Turntable Motor Speed

Q. My turntable motor does not come up to speed for several minutes after it is turned on. I know the motor is at fault and not the drive because I removed the platter and watched the motor shaft after turning on the machine. The motor ran slowly for several minutes. Then it suddenly picked up speed. I found that once the motor did come up to speed, it was the correct speed as determined by a stroboscope. What is the cause of this condition? How can it be repaired? H. A. Cumming, Rochelle Park, N.J.

A. Your turntable motor does not come up to speed for either one or both of the following reasons:

The first and most easily remedied is simply a lack of lubrication of the motor bearings. Use No. 10 oil or as otherwise specified by the manufacturer. This is a good time to lubricate the rest of the turntable assembly.

The second reason for the failure of the turntable motor to come up to speed quickly may lie in a defective phase shift capacitor if the motor involved is of the hysteresis type. To remedy this trouble, replace the faulty capacitor.
(It is connected in series with one of the windings of the motor.)

Taping from FM

All of my stereophonic recording and reproducing equipment is new and in excellent condition.

We have two FM stations which simultaneously broadcast high-quality taped material in stereophonic sound, each station broadcasting one channel of the tape. I have been attempting to record these programs on my stereo tape recorder. Thus far I have had little success, due to a peculiar condition which I cannot understand. The two stations are heard loud and clear with perfect reception. I made the recordings with the exception of the usual excellent results. When I played back the recording, station A sounded very good. Station B has a sort of whistling background interference, a vague, high-frequency hash. I find this situation only after the recording has been made and during playback. Separating the tuners by as much as 20 feet does no good at all. Neither does reversing the stations as re-

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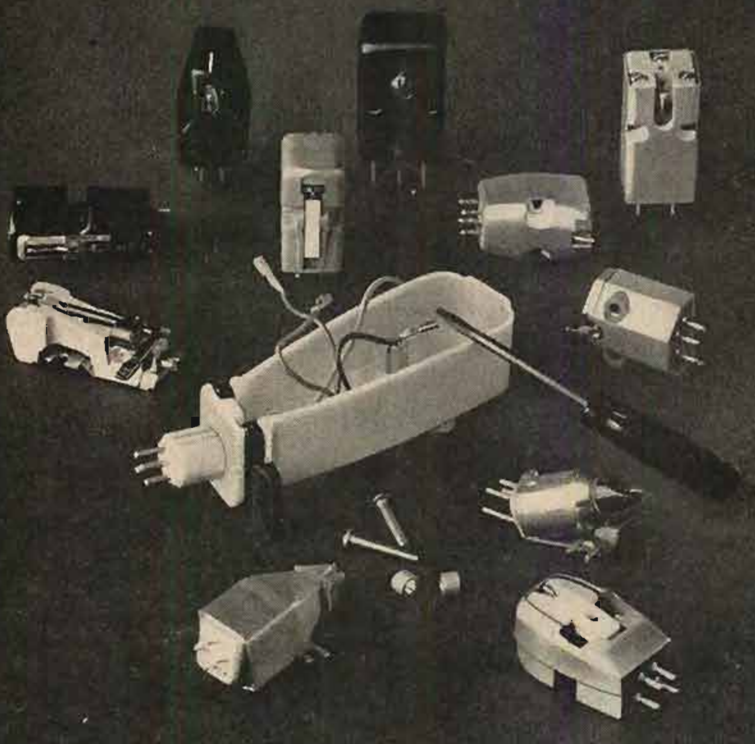
* *3420 Newkirk Ave., Brooklyn 3, N.Y.*



"Which cartridge do you recommend for the Type A?" "Can I use the professional models?"

THE ANSWER IS: *Use the cartridge of your choice ...any manufacturer, any model!*

The arm on the Type A will bring out the best in any cartridge ... tracking (and tripping) at the lightest pressure specified by the cartridge manufacturer. This includes the professional models, which were developed originally for separately-sold tone arms because of their high compliance. ☐ Now, Garrard integrates precisely such an arm into the Type A Automatic Turntable. This is a dynamically-balanced, counterweighted arm, designed and built with the same precision, the same balance, the same freedom from friction, the same playback characteristics and low resonance expected in tone arms separately sold, regardless of price. The Type A arm, operating in conjunction with a weighted, full-size, non-magnetic turntable; a laboratory-balanced, double-shielded motor; and (when you want it) the gentlest automatic record-handling mechanism ever designed; rewards you with the full measure of the magnificent reproduction achieved by any of the latest, finest, stereo cartridges. ☐ *Extravagant concept, yes...but the price of the Garrard Type A Automatic Turntable is exceedingly modest, only $79.50.* For illustrated literature, write Dept. **GM-11,** Garrard Sales Corporation, Port Washington, N. Y.

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gards the tuners improve the situation. This proves that if one tuner is at fault, then both of them are.

The foregoing is true of one station only, even when this station is used for monophonic recording. Some months ago, when station A was doing the same type of broadcasting but with a station C, I got some very fine tapes.

What can I do to remedy this unfortunate situation? Harry E. Hydal, Glendale, Calif.

A. This is an odd one, all right, and is a situation which will be repeated again and again unless tuner and multiplex adapter manufacturers take this into consideration. As you know, stereo multiplex broadcasts are just around the corner. Even though very few are taking place at this time, some stations are broadcasting multiplexed background music transmissions.

What has this to do with your problem? Let us assume that station B is transmitting just such a background music service. Thus, the transmissions from this station contain a subcarrier whose frequency is outside our hearing range. All tuners possess some kind of de-emphasis network to reduce high frequencies as prescribed operating procedures. A de-emphasis of the type used in tuners is of simple RC design. This means that the signal from the carrier is not likely to be completely suppressed and could still appear in the output of your tuner. I think that this subcarrier is getting into your tape machine and beating with the bias oscillator. (This beat tone is the background hash you are hearing.) Since this occurs at the recording head, the sound would not be noticed during the monitoring of the program unless the machine were equipped with a separate playback head.

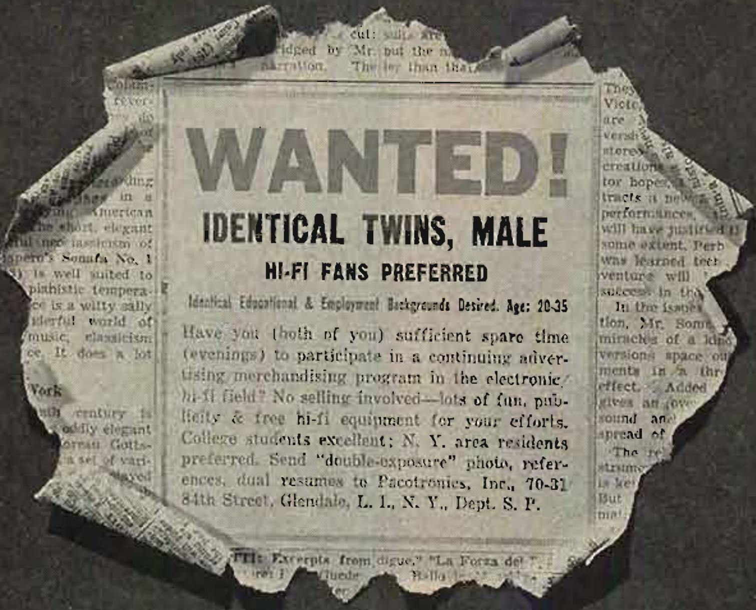
If the foregoing assumption is correct, a low-pass filter must be designed to be placed between the output of the tuner and the input of the tape recorder.

Phase Reversal in Preamplifiers

Q. I would like to use cathodyne phase splitters in the output of a preamplifier I am designing to enable me to reverse phase on one channel merely by switching the output from cathode to plate. Should I use any frequency compensating circuits to equalize the possible differences in the two circuits, or will that be unnecessary? William W. Kirkness, New York, N.Y.

A. You do not need any frequency-correcting networks. Just remember that a phase-splitter circuit is highly degenerative. Compensation in such a circuit is automatic. These circuits are sometimes accused of having a slightly rising response because of the small capacitance to ground created by the heater-cathode capacitance. This rise, however, if it exists at all, is small. It will be produced in both the plate and cathode circuits.

The effect of such a rise can be further reduced by making the cathode and plate resistor as low in value as possible. This will mean that the reactance of the heater-cathode capacitance will have to be larger to create this rise than would be true when higher values of cathode and plate loads are employed. Æ



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Feb. 5th:

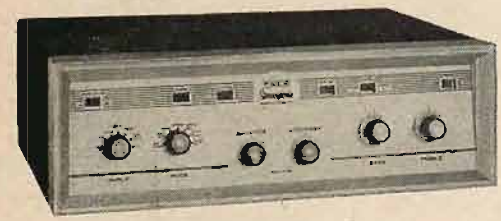
(Paco ran this ad in The New York Times)

Feb. 27th:

(the Taylor Twins began their duel of kits!)

Don and Larry Taylor, with twin backgrounds and skills, have competitively built kit after kit, Paco vs. other makes. In one test Don built the Paco, in the next Larry did. Net results: Paco kits proved faster, easier, and better in performance. ***For a typical Twin-Test report turn the page.***

HERE ARE JUST A FEW OF PACO'S NEWEST KITS:

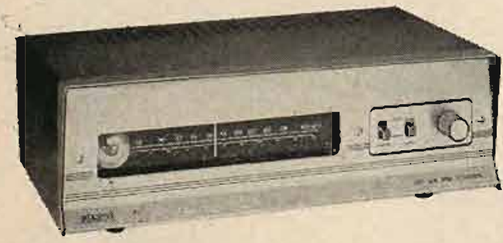


SA-40 STEREO PREAMP-AMPLIFIER: Power: 20W (RMS) per channel, 40W total. Peak, 40W with 80W total. Response: 30 cps to 90 Kc, within 1.0 DB. Distortion: within 0.5% at 20W per channel. Includes: 14 inputs and 14 Panel Controls, black and gold case.

SA-40 Kit with enclosure, "Twin-Tested" operating assembly manual......$79.95 net

SA-40W: Factory-wired, ready to operate..............................$129.95 net

SA-50: Stereo Kit as above with different styling, 25w per channel..............TBA*



ST-25 FM TUNER: Sensitivity: 1.5 microvolts for 20 DB quieting. Harmonic Distortion: less than 1%. Includes: Dual Limiters, AFC and AFC Defeat, "Eye" type tuning indicator, Multiplex jack. Black and gold case or walnut enclosure at slight extra cost.

ST-25 Kit with fully-wired prealigned front end. "Twin-Tested" manual....$42.95 net

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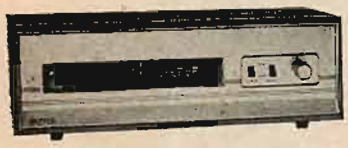

FM-TUNER/AMPLIFIER (ST-26) AND SPEAKER (L-3) KIT COMBINATION: This low-cost component high fidelity FM radio system is ideal for professional offices, dens, basement playrooms, stores, etc. They're fun to build thanks to Paco's "Twin-Tested" operating assembly manual.

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L-3 Speaker Semi-Kit: Complements the ST-26 in size and appearance. Lifelike response from ultra-compact, high efficiency speaker in walnut finished cabinet..........TBA*

L-2 2-WAY BOOKSHELF SPEAKER SEMI-KIT: A long-excursion 10" Jensen woofer and Jensen compression horn-type tweeter in solid, acoustically-crafted factory-built cabinet for vertical or horizontal mounting. Response: 45 cps to 15 Kc; Nominal Impedance: 8 ohms overall. Includes: Adjustable Brilliance Control; Built-In Crossover Network.

L-2U Semi-Kit: Unfinished. Complete with "Twin-Tested" operating assembly manual ....$59.95 net

L-2F Semi-Kit: Walnut finish on all four sides. Complete with "Twin-Tested" operating assembly manual....$69.95 net

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Fully Transistorized: 5 transistors, low battery drain for very long battery life.

Fast, Easy Readings: over-sized scale with 1-ft. calibrations from 0-120 ft.

DF-90 Kit: Complete with "Twin-Tested" assembly operating manual..$84.50 net

DF-90W: Factory-wired ....$135.50 net

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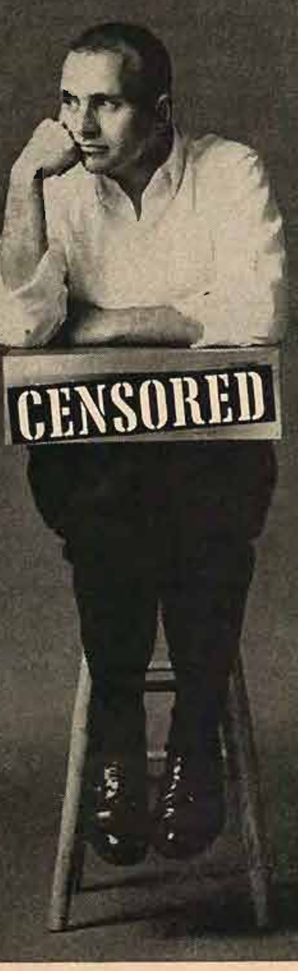
"I built the Paco SA-40 Stereo Preamp Amplifier."

Larry Taylor, 8 Stevens Place, Huntington Station, N. Y. "It took me one-third less time to build the Paco kit than it took Don to make the almost identical preamp-amplifier by another kit maker. But it wasn't just the time; it was knowing you're using the right part, and that you understand the instructions completely. Paco parts are all pictured and labelled, the resistors are neatly mounted on cards for easy identification. And Paco's instruction book doesn't leave you guessing. The fold-out diagrams and drawings are always right beside the instructions, so you're not reading one part of the book and following a diagram in another part. Photographs in Paco's book show how each assembly should actually look. I enjoyed building Paco kits, because I wasn't wasting time or worrying."

MEET THE PACO TWINS IN BOOTH 438 AT N. Y. HIGH FIDELITY SHOW

"I built a competing Stereo Preamp Amplifier."

Don Taylor, 39 Cross Street, Smithtown, N. Y. "Neither Larry nor I are speed demons because we're very meticulous about wiring and soldering. So I was even more surprised when it took me 50% more time to finish my kit. My problem began when I tried to separate the parts. The resistors were in boxes, but not in any logical way: identical resistors often wound up in different boxes. The instruction book was clumsy to work from. It caused wasteful mistakes. Once I lost 20 to 25 minutes because I misread a tiny key letter that meant not to solder a certain connection. A lot of the fun of kit-building was lost when I had to spend time making up for shortcomings of the packaging and the instruction manual."



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(Continued on next page) ⟶

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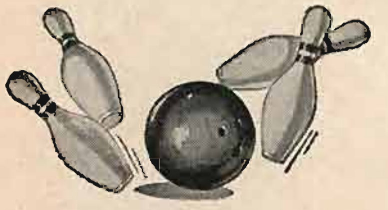

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13½ times as much as you gave to fight cancer

Shocking? Yes. And here's another shocking fact: in 1961, cancer will strike in approximately two out of three homes.

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Fight cancer with a checkup—and a check to the **American Cancer Society.**

LETTERS

IS OUR FACE RED!

SIR:

The face of the man responsible for the EDITOR'S REVIEW in the August issue should be quite red; quite red indeed!

Two years after the National Bureau of Standards had announced that it was changing from µµF to pF, you finally come around to it too, but you don't even check up on how the word is spelled! "Picafarad" my eye! The word is "Picofarad. I hope you will be man enough to correct the mistake next month. (*See! We are.* ED.) If you have to save face, blame it on the printer, but I think you owe it to your readers not to let such a glaring mistake go uncorrected.

And while you are at it, you might publish also the other prefixes adopted by the NBS at the same time; they are:

T = Tera- $= 10^{12}$ m = Milli- $= 10^{-3}$
G = Giga- $= 10^{9}$ µ = Micro- $= 10^{-6}$
M = Mega- $= 10^{6}$ n = Nano- $= 10^{-9}$
K = Kilo- $= 10^{3}$ p = Pico- $= 10^{-12}$

Thus, 15 Nano-seconds are 15×10^{-9} seconds, which used to be—and often still is—called 15 Milli-microseconds. If these designations will be adopted across the board, we will not be talking about Kilo-Mega-cycles any more, but they will be called "Giga-cycles. I don't expect to see that day, however.

British engineers have been using the pF for a long time; as a matter of fact, when talking to each other they do not put 15 Picofarads here and 80 Picofarads there—they put 15 "Puffs" here and 80 "Puffs" there, which I think is cute.

WALTER RICHTER,
8575 N. Hawthorne Rd.,
Milwaukee 17, Wis.

SIR:

. . . Granted it (the picofarad) is a highly useful unit, with a convenient abbreviation, pf. However, it is correctly spelled picofarad (pronounced pee-co-far-ad), and shouldn't be confused with pica type. While I have met up with the new prefixes in electronics courses since, I first heard about them in AUDIO (in the Letters column, September, 1958), so I feel that AUDIO has a special responsibility in using the new terms and using them correctly. Hence I am pleased that you are planning to use pf. . . .

PHILIP N. BRIDGES,
5100 Randolph Rd.,
Rockville, Md.

SIR:

May I commend the good intentions expressed in your editorial of August. Unfortunately you succeeded in accumulating two mistakes of terminology. As a European reader and a citizen of France, home of the metric system, I am perhaps oversensitized in the glorious mess revealed in this respect by reading most American technical papers. Not only do most authors ignore the metric system but they butcher it maliciously.

. . . (picofarad) is *not* abbreviated "pf," but "pF." There is an accepted terminology in use throughout the scientific world except with some American technical magazines. Clarity, precision, accuracy should be qualities attached to any published technical paper. In a publication of the status of AUDIO, a little editing on that subject would enhance the standing of your articles.

As other examples of most found errors: megacycles should be MHz (megahertz) instead of mc or MC; decibels should be dB instead of db; milliamperes should be mA instead of ma; kilowatts should be kW instead of kw or Kw. . . .

BERNARD R. MALANDAIN,
41-50 78th Street,
Elmhurst 73, N.Y.

And that was not all of them! We are now busily engaged in writing "picofarad" 1000 times on the nearest blackboard (or should we have said one kilotimes?). At least, we probably will not make this mistake again.

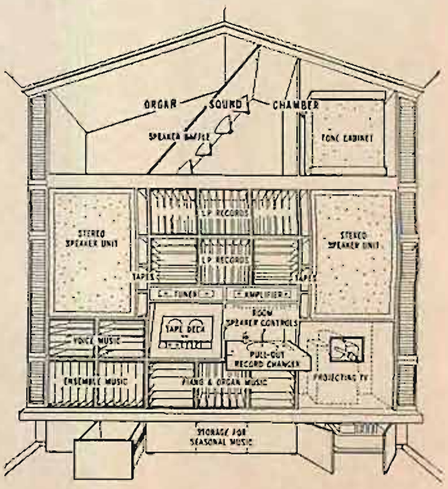
While we recognize the reasons for the use of capital letters in abbreviation of this type, we feel that less capitalization makes for easier reading. Unless nearly everybody objects, we shall continue to use lower case letters in db, ma, mh, pf, and so on. ED.

THIS MONTH'S COVER

From the 1960 Pace Setter, which was described thoroughly in *House Beautiful* beginning with the February issue, comes this music wall—only a tiny portion of the remarkable facilities of this dream home. Quoting directly from *House Beautiful:* "The ever-increasing array of appliances for entertainment and entertaining has become part of everyday life. Television, radio, and all the accoutrements for sound reproduction are as much with us as plumbing and heating. . . In this house all these elements are brought together, creating a household center for musical enjoyment throughout the house, along with plenty of space for a big library of records, tapes, sheet music, and scores. Also included are sound chambers for the organ speakers and the stereo system, and a TV set that projects from the rear onto a large screen."

The diagram at the right shows the interior arrangement of the music wall with Bell Sound tuner, amplifier, and tape recorder making up the basic high fidelity system.

For a complete description of the 1960 Pace Setter—with many elaborate photos and diagrams—the reader really should locate a copy of the February, 1961, issue of *House Beautiful*, through whose courtesy the diagram was furnished.



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LIGHT LISTENING

CHESTER SANTON*

Sound Effects, Volume 2
Audio Fidelity DFS 7010

There's nothing like a fresh batch of sounds-in-stereo from AF to put a group of voice coils on their mettle. The value of this series by Audio Fidelity extends in several directions. It gives a new dimension in frequency range to the challenging "big" sounds that have intrigued earlier recording technicians. It introduces an entirely new group of heavy-duty sounds for our amazement. Then, to cap it all, they go after some sound patterns of an extremely subtle and illusive nature. In Volume Two, unlike the first release, the grooves are not locked at the conclusion of each band. The twenty-four bands on each side of the record require no further attention once the side is begun.

About one fourth of Volume Two is devoted to animal sounds, ranging from the roar of African elephants to the different efforts of lambs and goats. As with sounds of a more mechanical nature, some animals register better than others on mike. The sea lions are particularly effective with the water acting as a sounding board. Among the sounds selected for floor shaking, the engines of a 707 jet liner going into action are still hard to beat. Crowding the jet for attention are the very realistic samples of heavy-duty motors and a coal-hoist winch room at a New York City utility plant. The natural attributes of stereo recording of moving objects get their best display in the flight of a helicopter, the shoveling of scrap metal (picked up in one channel and dropped in the other) and a truly profligate throw of dice. There are several remarkable examples of room presence created by the echoes of a fencing session and a handball court. There is more than one surprise in store for the audiofan in this release. My favorite is a sound I never expected to hear on a record—the dealing of playing cards. The soft whisper of each card as it lands at one of four widely-separated points speaks volumes for the sensitivity of the Audio Fidelity process and that of any system capable of reproducing it.

Pal Joey (Duophonic Process)
Capitol DW 912

Capitol has decided to try its luck in the conversion of old mono recordings into approximations of stereo sound. Their Duophonic process is quite simple—to the ear at least. It avoids the complicated winnowing of frequencies that is part of the RCA method unveiled some months ago in the Toscanini pseudo-stereo recordings. Then too, Capital's task is made easier by the fact that the mono recordings selected for the first release are technically superior to most of the Toscanini items processed by RCA. There is less opportunity for the introduction of distortion because Capitol makes no effort to relocate the sound of the individual instruments according to tonal range. The only claim made for the Duophonic process is one of added space illusion. Since some of the original releases date back to 1951, part of the improvement in sound is tied to factors that have nothing to do with the Duophonic process. Part of the credit lies with better surfaces and more sophisticated design in cutters.

Many of the tracks in this issue of the film version of Rodgers and Hart's "Pal Joey" are presented in authentic stereo, providing a fine opportunity to compare on one disc the virtues, if any, of the remaining tracks heard in the Duophonic process. The frequency response throughout the disc is quite uniform. It maintains an average that is representative of a good modern stereo disc. Going from stereo to Duophonic, you can spot the difference immediately in the widening of the vocal sound source. Frank Sinatra has some of the best songs in the score and he delivers them from center stage. Normal stereo pinpoints the exact location of his larynx. In Duophonic, his voice appears to issue from a fused source but the width of the sound implies the existence of three heads instead of one. A flick of the phase-reversal switch had no effect on the sprawling nature of the voice. The merits of this process are most apparent when it is heard immediately following a mono recording of the same material. A Duophonic disc invariably sounds better because the stereo cartridge gives you, instead of the phantom center fill, a curtain of sorts that does cover the entire area between the speakers.

Ella Fitzgerald Sings the Harold Arlen Song Book **Verve ✪ VSTP 254**
Tony Bennett Sings Harold Arlen
Columbia ✪ CQ 356

The composing career of Harold Arlen fits neatly into the span of the last three decades. His first tune, "Get Happy", was introduced by Ruth Etting in the Nine-Fifteen Revue back in 1930. Arlen's music certainly deserves the attention it is currently getting in tape circles. It has the unextinguishable charm of the truly great men of American music who will always figure prominently in any well-balanced tape library. Along with Berlin, Kern, Rodgers, Porter, Gershwin and Youmans, Harold Arlen caught the true flavor of his generation. Much of his distinctive approach to a popular song may be traced to his formative years when he worked for a series of annual shows at Harlem's Cotton Club. This very hep-for-its-day night spot attracted audiences fully as glittering as any seen on Broadway. The saucy, bitter-sweet quality of his ballads and near-blues is part of an era that permitted the songsmith to practice his craft without hindrance from business, attorneys, tax specialists, and other distractions of that sort.

Ella Fitzgerald has every desirable quality of background and experience to make this a definitive Arlen song book. A great many record and tape fans are sure to buy this recording without hesitation (either a two-disc album or one Twin-Pak reel), basing their purchase on the reputation of previous Fitzgerald song books. They won't find the same uniformity in the condition of her voice that was evident in Ella's song books of two years ago. The Gershwin set is still my favorite but I can't think of another singer today who could deliver all these Arlen tunes with Ella's instinctive nuance. There is a flip yet very human quality in the way she sets forth the old depression favorite "Let's Take a Walk Around the Block." Ella can then turn around and charm us with the classically simple "As Long As I Live," introduced in the Cotton Club Parade of 1934 by a teen-ager named Lena Horne. In the well-paced arrangements, Billy May lends his usually reliable orchestral support. Another tape puzzler in this reel. Considering the importance of this particular project, it is difficult to understand the casual listing of the selections on the album box. "Ill Wind" and "It Was Written in the Stars" are mentioned on the box but do not appear on the tape.

Tony Bennett, in the Columbia reel, demonstrates, in addition to a hearty enthusiasm, the enormous scope of the Arlen library. Bennett uncorks five additional tunes in the course of a collection featuring arrangements by Glenn Osser. Add these to the two dozen in the Fitzgerald reel and you have enough Arlen songs to take care of anyone's most pressing needs. The items added by Bennett to Ella's list include "House of Flowers," "For Every Man There's a Woman," "Right as the Rain," "What Good Does It Do," and "Fun to be Fooled." In the sound department, Columbia has an appreciable edge in audio quality.

Frank Chacksfield: Movie Themes
Richmond ✪ RPE 45026

Richmond is still shipping from England master tapes that permit the release of reasonably clean-sounding four-track reels. For some reason, however, the recording characteristic of a typical Richmond tape still differs from a typical reel bearing the label of the parent firm—London Records. The contrast is most significant in the bass response. Even allowing for the fact that London tapes seem to average a bit more strength in the low end than do the reels of most labels, Richmond seems to be making little or no progress in the bass department. You can spot this quite easily on any system capable of handling the full response of London tapes. Going beyond the particular combination of tapes encountered this month (Chacksfield *vs.* Ros and Mantovani), the general results I've been getting with Richmond and London tapes for the past year point to one of several possibilities. There is a remote chance that, in processing, United Stereo Tapes decided on its own whim to roll off the low end for esthetic or other reasons and that this decision has somehow escaped the notice of London Records. Such a combination of events is almost impossible to believe. Another explanation may lie closer to the facts. UST is probably acting on instructions which spell out exactly how much better a London Tape is supposed to sound than any reel with a Richmond label. I'll bet two pairs of output tubes (the only easily movable items always on hand) that someone at London is convinced that a listener willing to pay only $4.95 for a tape is going to play it on a unit that might come loose at the joints with the first thrust of 50 cps in the speaker. Here, at any rate, is one vote for some of that London-style bass. The top end of Richmond tapes offers no great problem because the pre-emphasis can be rolled off but bass response that has to be propped up at an angle in the preamp is no joy to these ears.

As for the music on this tape, "Gigi" and "Just in Time" from *Bells Are Ringing* get the best treatment here. Fiddles attempt to duplicate the bite of authentic Greek instruments in "Never On Sunday." In the River Kwai March, flutes, piccolos, and drums introduce the theme in the left channel before relinquishing it to the full orchestra.

Edmundo Ros: Sing 'N Clap Along
London ✪ LPM 70046

What are they doing to Edmundo Ros? Here is an orchestra that has built an enviable reputation for the smartness of its crisp Latin style. Now it finds itself involved in a sing-along album devoted to

(Continued on page 94)

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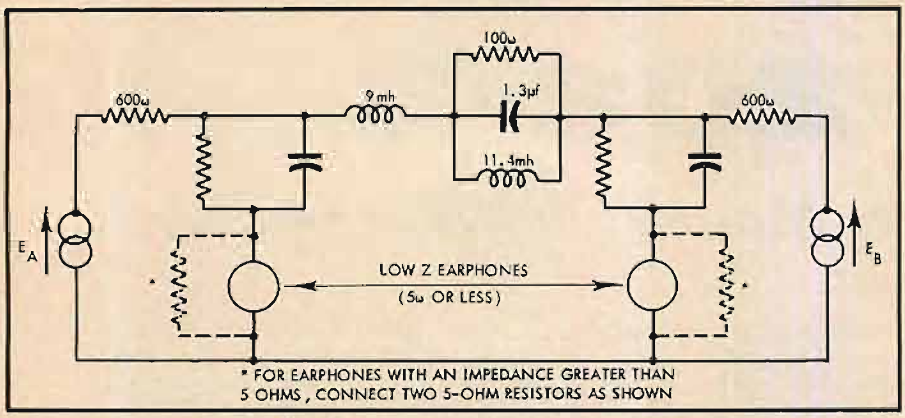
AUDIO ETC.

Edward Tatnall Canby

1. BAUER CIRCUIT

The so-called (by me) Bauer circuit, for converting binaural earphones into simulated stereo receptors in order to listen to stereo recordings, has kept letters coming into this department month after month, until I finally wrote Mr. Bauer for permission to print a version of the circuit here. Permission was forthcoming, and you'll find the circuit below—though I should say that what you really want is the complete technical discussion, as published in the Journal of the Audio Engineering Society. (As previously explained, papers on the circuit were presented at AES meetings in the spring of 1960 at Los Angeles and in the fall at New York—it has been that long.)

Mr. Bauer presents two versions of his circuit, for different impedance situations, plus a third that reverses the circuit to treat binaurally recorded material for presentation through stereo speakers. He recommends the circuit presented here, intended for low-impedance phones (5 ohms or less) but adaptable via two resistors, as indicated, for phones of higher impedance.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11.4mh
E_A
E_B
LOW Z EARPHONES
(5ω OR LESS)
* FOR EARPHONES WITH AN IMPEDANCE GREATER THAN 5 OHMS, CONNECT TWO 5-OHM RESISTORS AS SHOWN

Fig. 1. The Bauer circuit for headphone stereo.

I expect that some readers will be moved to emit a humph—so *that's* all there is to it. The circuit, to be sure, is not sensational as such and in the abstract. It isn't the circuit that's important (though the values were obtained with considerable ingenuity from earlier hearing studies and with the aid of a computer). It's the idea itself that is interesting. As many readers have recognized, it has a kind of Columbus-and-the-egg simplicity, a clever idea and admirable merely for having been thought of at all.

Among interesting letters on the subject, I cite a recent one from a man who has suddenly lost a considerable part of his hearing, after years of hi fi and stereo enjoyment. He has found that via earphones he can regain some of the well-remembered hi fi pleasure of the past, but he is not at all satisfied, he says, with binaural reproduction of many of his stereo recordings and therefore wants to experiment with the Bauer circuit. Here is one instance, at least, where the circuit may be the only possible means of access to a stereo effectiveness.

But he'll have to be careful about his levels, though. If the two phones are to be operated at different levels (to match his ears), he will have to be sure that the circuit "sees" the incoming signals in their original relationship.

2. REFLECTION COUPLER

Some months ago, a concern down in Maryland purchased the old and familiar Scott Radio Laboratories name from its previous owners and went about introducing a new line of hi fi goods, featuring an ingenious "compromise" one-piece stereo speaker system that sprays sound out of the back of a cabinet against the room wall. This development, called the Reflection Coupler speaker system, is now being actively promoted, but meanwhile this Scott company had ran afoul of the other Scott, H. H., and (for your information) is now re-named Ravenswood. I found I couldn't remember this for five minutes, until the editor reminded me that we have a writer in our field who goes under the same title; anyhow, I've got it memorized at last. RAVENSWOOD Reflection Coupler speaker system.

Now when I first heard of this thing I was pretty darned skeptical. A "one-piece" stereo speaker system, a single cabinet and not a very big one at that! I had not yet heard any single-cabinet stereo worth the name. I remained highly suspicious of all stereo arrangements that attempted to compromise with what seemed to me essential, the wide separation of two *individual* speaker enclosures. I was perhaps a bit cynical; for I'd found only too often that in such compromises something is always very wrong. Either the one-piece cabinet is small and good looking but its stereo simply does not exist, or the cabinet is monstrously big, ugly and expensive in order to achieve real stereo spread. It simply did not seem possible to me that a really workable compromise might be devised in one piece for stereo, not too large and yet producing practical stereo sound.

I narrate that in the past tense, because the Reflection Coupler has done quite a bit to change my mind. I guess you *can* produce listenable stereo from a one-piece cabinet in a big room, if you go about it in this fashion.

I won't say that as a relative purist I have gone to the dogs and have abandoned my principles. I still believe that the easiest way to get good stereo is to use two *separate* (and identical) speaker systems, flexibly adjustable as to position. I will eventually be going back to my separate speakers, I expect. Nevertheless, I've learned something new.

Let's look, then, at the major non-musical element in this system and its main argument for existence, the highly practical and quite unique value it offers as sheer furniture. Impressive, let me tell you.

The Reflection Coupler unit comes in various models and sizes and shapes, but the basic idea is what matters, the concept of a piece of hi fi furniture that has no visible and obstructable openings, no grilles, no doors, on the front, on either end, or on top. The entire sound system is inside and vents to the rear against the wall of the room, via a highly refined system of slots and transparent (Plexiglas-type) plastic reflectors. The cabinetry, in all its forms, pushes to within about two inches of the wall and is positioned there by the reflectors themselves, mounted down behind and out of the line of sight.

It's a really hot idea, more so than you might think from a mere description. The model I received is a "lowboy" bench, just high enough to sit upon, about a foot and a half wide and under four feet long, on low legs. It is perfect as a low table, too, and in minutes I had it covered with odds and ends—three pots of African violets, a pile of magazines and a couple of small pillows. The thing fitted into my room practically instantaneously, and it looks good, too. Indeed, though I have now perforce switched my stereo output connections to another speaker system, the Reflection Coupler is still in place, though silent; it's much too useful to remove.

The reason for its usefulness, aside from simple good looks and practical shape, is inherent in the design. Unlike any other piece of hi fi I've seen, this one requires no free space in front, nor space to the sides (with some qualification, as below), and its top is entirely usable at all times, to be sat upon, stood upon, cluttered up with junk or piled with decorative things to look pretty. You'll never have to sweep off the top surface of its loose objects, to get at something inside. It thus takes up an astonishing minimum of practical space, this unit, because it can be used freely as part of the room; most sound systems, in contrast, require a large area of "deactivated" space in addition to the area directly beneath them. Space in front, space at the sides, space on top.

You can begin to see why this sort of hi fi packs a big pull for the housewife-shopper and for plenty of husbands as well. It's so very good as furniture that the majority of us forget about a fairly important question, *how does it sound?* Most people, remember, really don't know enough about sound values to make judgments, especially in stereo terms, as to sound versus convenience. If the sound is any good at all, the convenience will win hands down.

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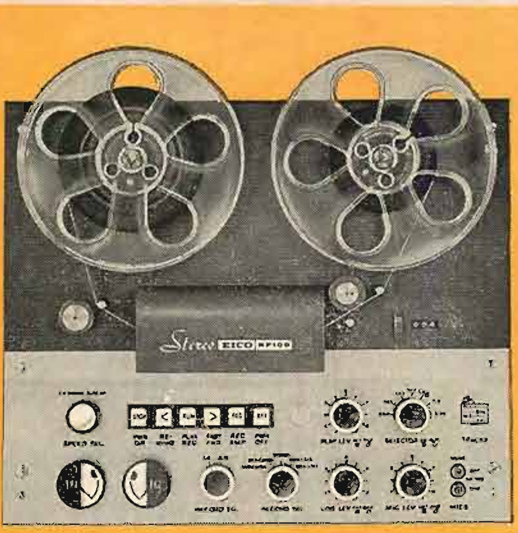

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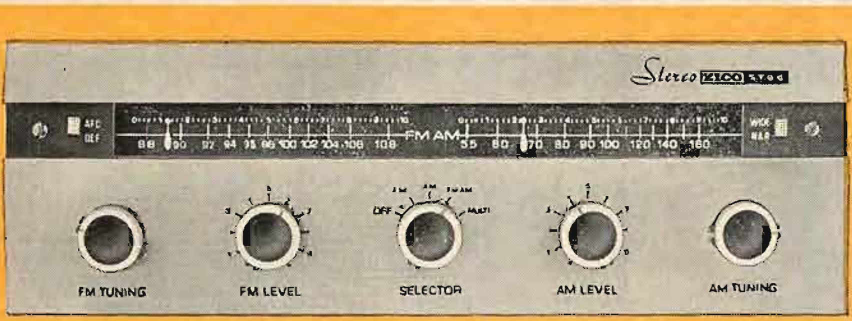

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Switched "wide" and "narrow" bandpass. High Q filter eliminates 10 kc whistle. Sensitivity: 3uv for 1.0V output at 20db S/N ratio. Frequency Response: 20-9,000 cps ("wide"); 20-4,500 cps ("narrow").

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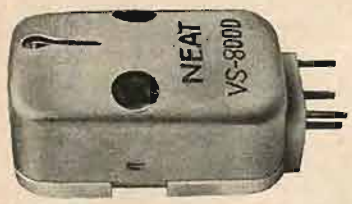

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SPECIFICATIONS

OUTPUT VOLTAGE ......5 mV, 1,000 cps, 5 cm/sec
FREQUENCY RANGE......10~20,000 cps.
CHANNEL BALANCE......±0.5 db, 1,000 cps.
CHANNEL ISOLATION ......Over 30 db, 40-12,000 cps.
COMPLIANCE......15×10^{-6} cm/dyne.
DC RESISTANCE......33 ohms.
IMPEDANCE......35 ohms, 1,000 cps.
LOAD RESISTANCE ......100 ohms to 100 kilohms
NEEDLE PRESSURE......1.5-3 grams
STYLUS......0.7 mil, diamond

GA-15
PROFESSIONAL STEREO TONE ARM PERFECT-BALANCE TYPE

The GA-15 tone arm provides a means of directly reading the needle pressure for all cartridges in the weight range of 1-20 grams. Perfect balance, too, can be maintained with this high-performance tone arm having a 4-terminal plug-in arm head. Any type of cartridges can be mounted on this torne arm.
Constructed with greater emphasis on its performance than on its visual features, this tone arm is free from arm resonance, that is, resonant vibration.

NEAT

4, 1-chome, Kanda, Hatago-cho,
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NEAT ONKYO DENKI CO., LTD.

As things stand today, most of the attractive equipment "compromises," as between furniture and sound values, are so one-sided, in favor of the visible decor, as not really to be compromises at all. It takes a balance of elements to make a compromise; most stereo one-piece consoles simply throw out the stereo in favor of convenience. People buy the stuff just the same. They mostly don't know the difference.

Take my neighbors across the road. She's a musician, studied music and dance, plays the piano. He's an artist and a senior professor at Columbia University. Cultured, educated people, and they have a Magnavox stereo portable. The portable case has one of the stereo speaker systems built into its front, in conventional portable fashion. The second speaker system is a small detachable box, on a cord. They find this arrangement most convenient for their musical needs, and for their living habits.

The portable itself sits unobtrusively in a corner of the living room on a small table, directly behind a large overstuffed chair. The speakers aim right into the chair back. Neat and out of the way. The extension speaker wire is strung up over a mantelpiece and the speaker unit is tacked over the top of a door on the other side of the room, facing out towards the adjacent sitting room.

Of course they never use the two speakers together. The convenient balance control allows them to shift the sound handily from one to the other. She uses the speaker over the door for listening in the sitting room or when she is cooking in an adjoining kitchen; the built-in speakers are turned on behind that stuffed chair when discreet background-classical music is wanted for small parties in the main room. Perfect.

Stereo? These people don't even understand that stereo requires listening to both speakers at once! If they do, I've never caught them at it. They borrow my stereo records, even so, and they are delighted to have a stereo machine, at last, so they can play them.

There, you see, is a rather typical upper-education high-level family, repeated in thousands today all over our fair land. Has stereo got to first base with these people? Hardly. Now if these neighbors by any chance were in the market for a separate speaker set-up (which they are not), I would suggest immediately the sort of "compromise" that the Reflection Coupler offers—for, by golly, they might at last hear some genuine stereo in spite of themselves. They couldn't help it.

The Reflection Coupler unit is a black box full of speakers, six of them, which may be enclosed in an outward layer of furniture. Mine has a solid hardwood top, a front panel and two end-pieces that incorporate a pair of legs each. I assembled this material around my black box, kit-style—the equipment had to be delivered to me unmounted thanks to my house being locked up and myself out of town when it arrived in the midst of a violent thunderstorm. They left it in sections halfway down my cellar steps, to keep it out of the rain. I'm a lousy carpenter and so I found myself putting wrong screws in wrong holes and generally mixing up the instructions I had received. The leg supports unaccountably screwed down into an inch of solid celotex board—the legs almost collapsed when I sat down on the bench; and so I found it wise to relocate the support a bit for a permanent joint, as obviously intended. I got the front panel on upside down too, with screw holes showing along the bottom, but I let that ride. But I do recommend that all Ravenswood customers of a more corpulent build take a discreet look at the underpinnings on these units and, maybe, put in some extra screws, for improved structural geometry, before they sit down too suddenly. Remember, this is hi fi on which you are *supposed* to sit down.

Once tightly assembled, I found the furniture both solid and tasteful and the wonder of it is that in truth you would never know it to be a piece of hi fi. People are much bemused, coming into my room, trying to figure where the music comes from. They hear it over by that handsome bench-table, but it does not occur to them that the bench itself might have something to do with it. And the fact that you can walk right up and sit down, or put your chair right in front of the bench, or near the sides, without interfering with the music, without blasting yourself in the face, is a real virtue.

What sort of sound, then, does this Reflection Coupler produce? A vital point, you'll insist again, but I have deliberately postponed it in order to set a properly impressive stage in terms of the unit's most immediate appeal, its non-sonic value. That is bound to be uppermost, alas, in most people's minds. If the sound is any good at all, the unit should be a raging success. It would sell, I think, even with positively lousy sound (by my standards) and hardly any stereo effect at all. So we must take things as they are and be thankful for small favors or big, for better or worse, as far as the actual sound is concerned.

Well, it's for the better, I'm glad to report. Take the "fi" first. The model I received was one of the fancier in the line, I gather, called the M12000. Pairs of 12-in. woofers, smaller mid-range cones and small tweeters, the woofers mounted facing downwards inside the cabinet into a species of slot, opening out downward and rearward. You can put your hand into the slot, it's that wide, and you can feel the cloth dust covers on the two woofer cones. This arrangement would seem to constitute a slot-loaded bass enclosure, though the complexities of two stereo woofers operating within one enclosure are more than I know much about. The two mid-range units and the two tweeters face directly rearwards; in front of each of them is a shaped transparent plastic reflector, Plexiglas or equivalent, the larger mid-range reflectors gracefully folded into an intricate W shape to send sound both ahead and sidewise along the wall, the smaller tweeter reflectors of a simpler cup-shaped design, like hands cupped behind ears. The highs are thus sprayed in a fan-shaped pattern along the wall, both upward and outward to each side, an essential aspect of the stereo projection pattern. All of this reflector-and-slot system, remember, is down behind the unit in the rear, "coupled" to the wall by the two-inch positioning that holds the unit near but not at the wall itself.

As to the sound, I found it surprisingly good, the highs smooth if slightly attenuated in the reflection (there's high and mid-range adjustment to compensate for this), the bass quite unexceptionably free from boominess. I guess I tend to assume that all fancy hi fi furniture tends to be boomy. Not this. No boom-peak, and I found that a speaking male voice confirmed my feeling of a flat bass response by being clean and light in sound. The smooth bass here is presumably a result of that slot loading which, if I guess right, should even out any peaks in the "boomy" area. I didn't try for the very low tones, but found that for musical purposes this unit went down far enough for musical utility.

I had only one reservation in the sound, not too easy to explain, a slightly hollow effect in the middle area, a cavity-sound, a coloration, like that when you blow on your

(Continued on page 83)

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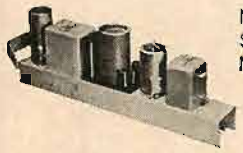

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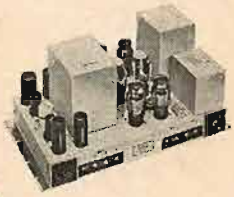

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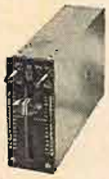

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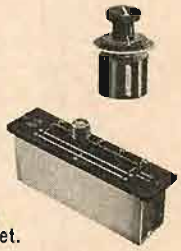

for positioning soloists across the sound field; 2 types: 1 channel into 2 channels and 1 channel into 3 channels. Available in horizontal or rotary styles. From $24.00 to $165.00 Professional Net.

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EDITOR'S REVIEW

FM STEREO RADIO

With this impressive title now accepted by nearly every organization as the term to be used in discussing what we first learned to call multiplex, the list of stations on the air is growing slowly, but is almost certain to pick up speed within the next month or so. Many stations are in the unfortunate position of having a transmitter which is not completely suitable for the modification, some have modified their transmitters so often already for one reason or another that they feel they should start with a new one and others simply have not yet had time to make all the necessary changes to their studio equipment. For not only does the transmitter have to be modified by the substitution of the exciter unit, the studio facilities must also be converted to stereo—which means that more lines are needed between studio and master control and from there to the transmitter, console facilities have to be modified if the engineer is to have the proper type of control, and turntables and tape equipment may need alterations. Up to now not every station has been equipped for stereo transmissions on FM and AM, and the changes may end up by being quite complex.

The opening of the New York High Fidelity show will see the inauguration of at least one station in the New York area—WLIR, located in the Garden City Hotel about a mile south of our offices. WLIR will broadcast in stereo direct from the Trade Show Building during the show, with WCBS, WRFM, and WNCN also originating shows there in mono. A few other New York stations should be ready to begin operations in stereo during September.

The list of stations now broadcasting in stereo includes: WGFM, the General Electric station in Schenectady; WEFM, the Zenith station in Chicago; WKFM, Chicago; KLSN, Seattle; KIXL-FM, Dallas; WDTM, Detroit; WUPY, Lynn, Mass.; WCRB, Boston; WOOD, Grand Rapids, Mich.; and KPEN-FM, San Francisco. We will bring the list up to date as soon as the information is available.

THE TAPE SURVEY

When anyone participates in a survey, he is naturally interested in the results, but all too often they are not made public—usually they are employed by whoever originated the survey to prove something or other. We might just do that, too, but we feel that the readers who were interested enough to respond are entitled to know what we found out.

Actually about nine per cent of our circulation did respond—which is remarkably good. Of those of you who have tape recorders, 65 per cent have stereo, 48 per cent having three-head machines, 38 per cent with two heads, and 14 per cent with more than three heads. One-track machines are owned by 16 per cent, two-track by 36 per cent, four-track by 27 per cent, and two- and four-track by 21 per cent. The speeds available range from less than 2 per cent with 15-ips machines, 7 per cent with 7½-ips machines, 12 per cent with 15–7½, 6 per cent with 15–7½–3¾, 12 per cent with 7½–3¾–1⅞, 60 per cent with 7½–3¾, and the remaining few per cent with three other combinations.

When it comes to tape buying, 12 per cent of you buy five or less reels of raw tape each year, 54 per cent buy from 6 to 24 reels, 22 per cent buy 25 or more. A few of you buy no raw tape at all, so we assume you use your machines only for playing recorded tape. Four per cent buy from 100 to 300 reels each year, three of you buy 400 to 500, and one rugged individual buys 1000 reels each year. Polyester tape is preferred 2 to 1, and 48 per cent of you buy the extra-play (1800 ft.) reels, 30 per cent buy the long-play (2400 ft.), and only 22 per cent buy the 1200-foot reels.

Of recorder owners, 22 per cent buy five or less reels of recorded tape, 31 per cent buy from 6 to 24 reels, and 6 per cent buy over 25, with stereo leading mono by 7½ to 1 and four-track leading two-track by 2 to 1. Headsets are owned by 55 per cent of recorder owners, and 25 per cent plan on buying a stereo headset soon. A staggering 9 per cent of owners plan to buy another machine to use for dubbing or to permit continuous recording.

Of those who do not own machines, 86 per cent will purchase, 5 per cent will not; the remainder do not say. Most of you—32 per cent—will buy in six months to a year, 22 per cent under six months, 22 per cent in one to two years, 7 per cent in over two years; 70 per cent prefer tape decks over portable machines, and 84 per cent will buy stereo. Speed preferences are 41 per cent for 7½–3¾, 14 per cent for 15–7½, 12 per cent for 7½–3¾–1⅞, 8 per cent for 15–7½–3¾, and a surprising 7 per cent want 15-ips machines only and 10 per cent want the 7½-ips speed only. The percentage in favor of four tracks is 55; two- and four-track machines, 24 per cent; two-track, 15 per cent; and one track, only 6 per cent. Head percentages are 55 for three heads, 35 for more than three heads, and 10 for two heads.

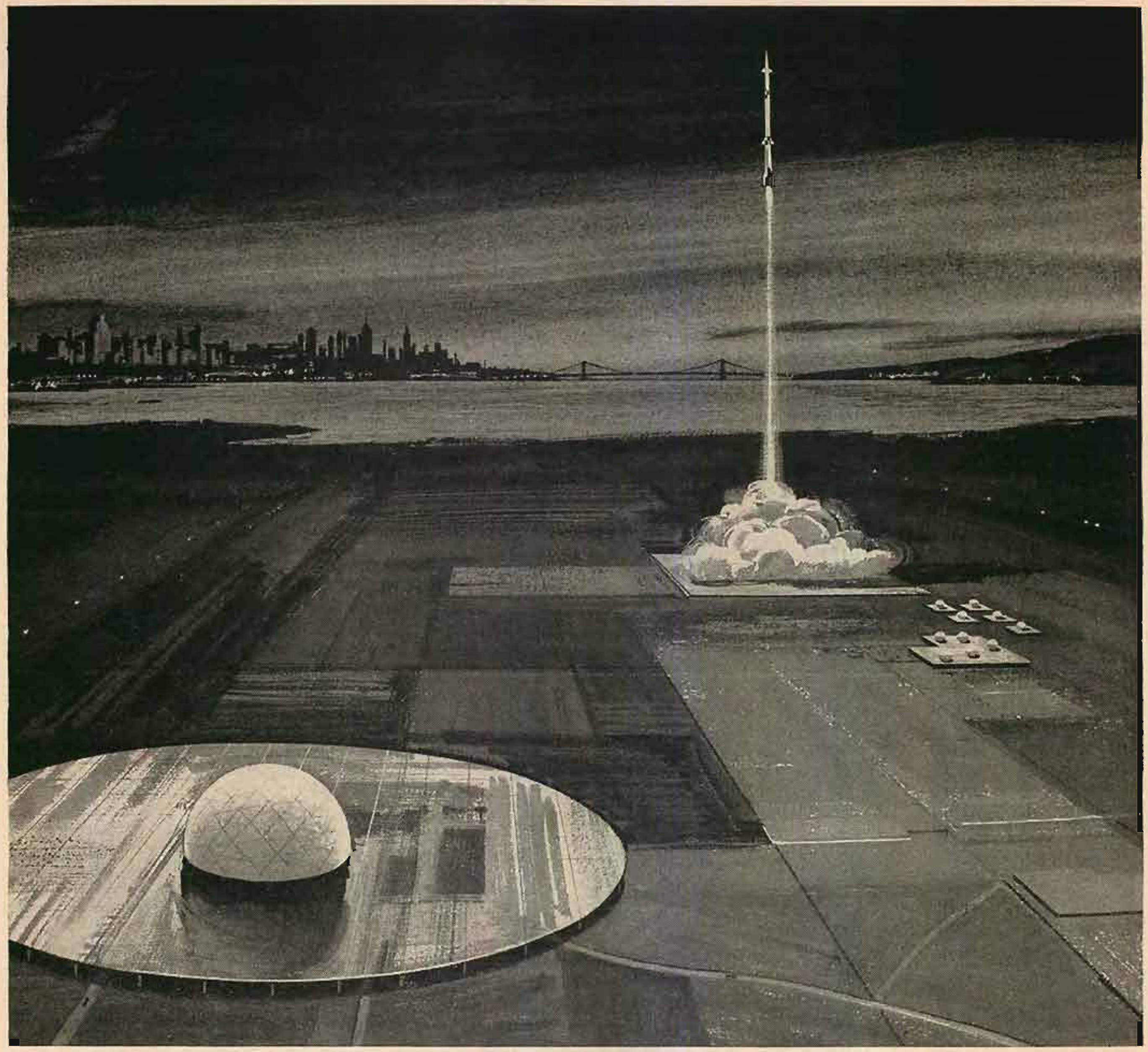
It all adds up to an interesting compilation of information about the tape habits of our readers, and we are grateful to those of you who "came through" with the little cards. As would be expected from Audio readers, nearly 70 per cent want semi-professional machines, 25 per cent want professional machines—or at least that is what they expect to buy (we all *want* professional machines).

One thing we learned from this survey—and that is why we made it—readers want more material on tape recorders and tape recording, and we expect they will want still more information as FM stereo gets under way. And so they shall have it, in future months.

PICKERING & COMPANY INC. offers the stereo fluxvalve pickup in the following models: the Calibration Standard 381, the Collector's Series 380, the Pro-Standard Mark II and the Stereo 90. Priced from $16.50 to $60.00, available at audio specialists everywhere.

"FOR THOSE WHO CAN HEAR THE DIFFERENCE"

Pickering and Company—Plainview, Long Island, New York



More than 450,000 pounds of thrust lifts the U. S. Army's Nike Zeus missile skyward in a cloud of vapor. The Nike Zeus missile being developed for the project by the Douglas Aircraft Company will be designed to intercept ballistic missiles traveling over 15,000 miles per hour, and destroy them at a safe distance from the defended area.

How do you stop an ICBM?

How do you detect, track, intercept—and destroy within minutes—an ICBM that is moving through outer space ten times faster than a bullet?

Bell Telephone Laboratories may have designed the answer: Nike Zeus, a fully automated system designed to intercept and destroy all types of ballistic missiles—not only ICBM's but also IRBM's launched from land, sea or air. The system is now under development for the Army Ordnance Missile Command.

Radically new radar techniques are being developed for Nike Zeus. There will be an acquisition radar designed to detect the invading missile at great distances. And a discrimination radar designed to distinguish actual warheads from harmless decoys that may be included to confuse our defenses.

The system tracks the ICBM or IRBM, then launches and tracks the Nike Zeus missile and automatically steers it all the way to intercept the target. The entire engagement, from detection to destruction, would take place within minutes and would span hundreds of miles.

Under a prime Army Ordnance contract with the Western Electric Company, Bell Laboratories is charged with the development of the entire Nike Zeus system, with assistance from many subcontractors. It is another example of the cooperation between Bell Laboratories and Western Electric for the defense of America.

BELL TELEPHONE LABORATORIES

World center of communications research and development

Another Power Amplifier!

R. A. GREINER*

Here's an amplifier that will loaf through the task of providing music throughout the house—and outdoors too. Also the distortion is extremely low.

THE READERS FIRST REACTION to this article on power amplifiers might very well be, as the title indicates, "Another power amplifier!" Still there are worth-while and interesting things to talk about with respect to vacuum-tube amplifiers. The amplifier described here and some of the design problems are just a bit unusual. In the first place, this is a very high-power amplifier in terms of the power levels which are usually used in high-fidelity systems. The amplifier itself is a relatively straightforward combination of well-tested audio circuits which have been presented in the literature over the years by various authors. This might well be the last of the vacuum-tube amplifiers as far as this writer is concerned. Perhaps a brief explanation of that last statement is in order.

For many years now it has been relatively easy to build essentially distortionless power amplifiers in the 50 or even 100-watt size. The only challenge has been to do it with fewer tubes, at smaller cost, and in the smallest possible space. It would seem that the next logical step would be to completely transistorize the power amplifier and thus make it even smaller and presumably more reliable. It is certainly a worthwhile goal—but it is also very difficult. In fact, at the present state of the transistor art it is very expensive to make relatively high-powered amplifiers with wide frequency response and low distortion.

In the case of the amplifier to be considered here, it was felt that the vacuum tube could be used with standard components to give the required design characteristics in the quickest time and with the least amount of effort. There was need for an amplifier which would deliver 100 to 150 watts under continuous duty sinusoidal output over the entire range from 20 cps to 20,000 cps. This requirement plus the inherent challenge presented by designing and constructing a really good high-power amplifier are the primary reasons for the existence of the amplifier design and design discussion which follows.

The final specifications which were set down for the amplifier are summarized as follows: Power output 120 watts continuous duty, frequency range 20 cps to 20,000 cps, 200 watts for short periods (5 minutes at a time), less than 2 per cent total harmonic distortion at 200 watts and less than 0.5 per cent at 100 watts (over the entire frequency range). These goals were attained in the amplifier described here. More detailed performance characteristics are given at the end of this article.

This amplifier is of course much larger than would ever be required in even the largest home audio system contained in a single listening room. There are uses for such an amplifier in addition to those which led to its construction however. For example, it is very useful as a central amplifier for distributing music to an entire house and garden where a large number of individual speaker systems are to be driven. It is also valuable for high-quality commercial sound distribution systems which carry music as well as voice. Even at a 50-watt average

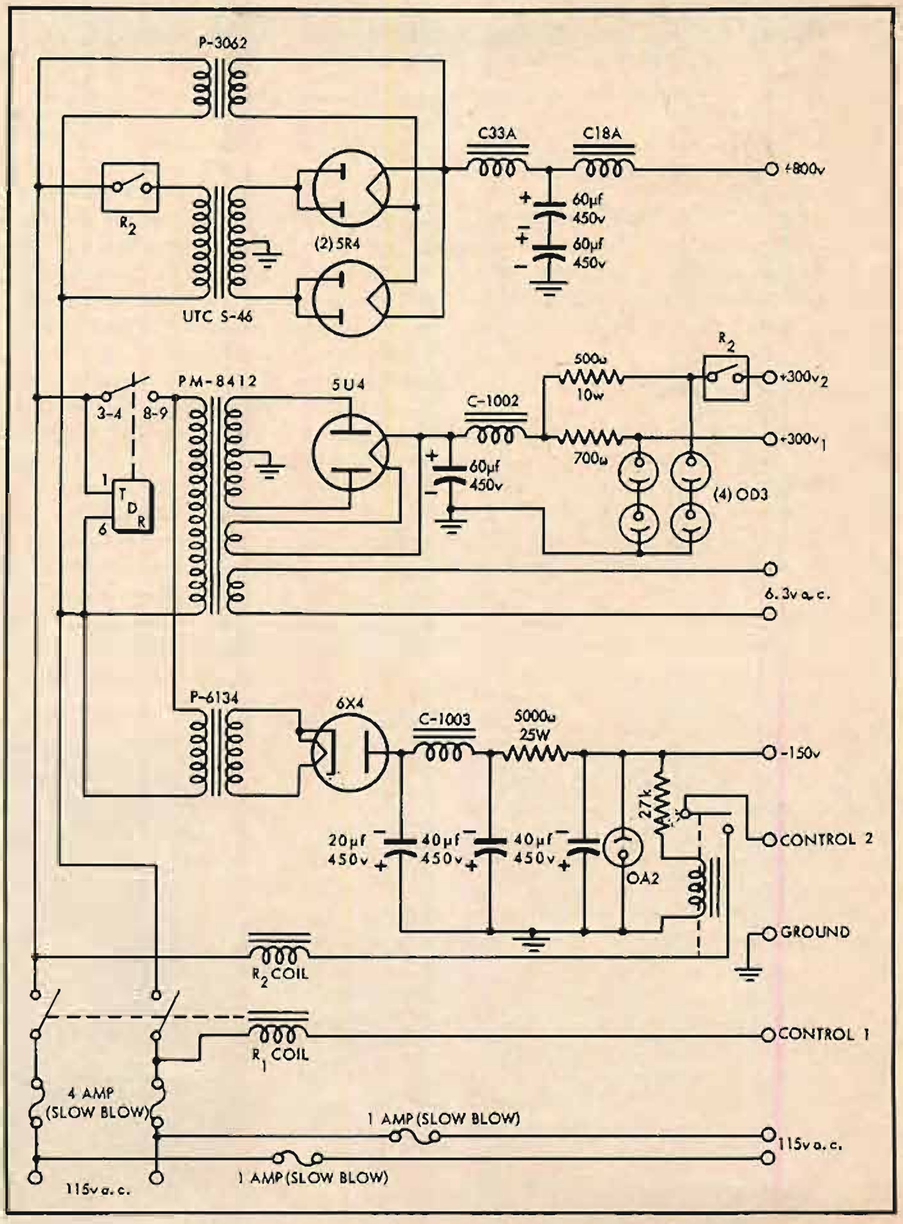


Fig. 1. Schematic diagram of the power supply.

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* *Department of Electrical Engineering, University of Wisconsin.*

care should be taken with the output- supply will have a rather interesting power in this case is 200-watts rms. This

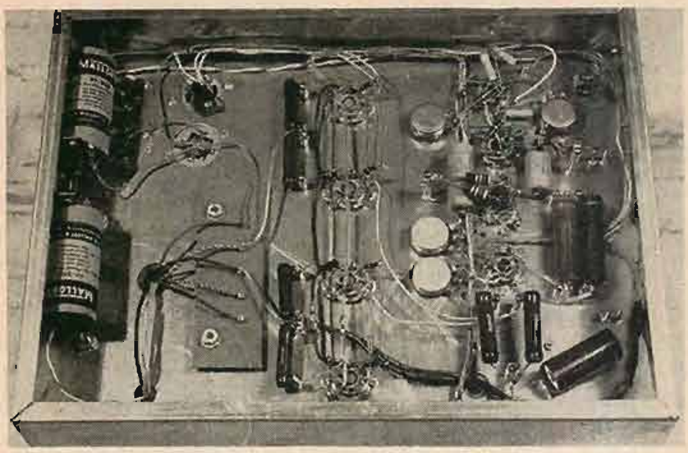

Fig. 5. Bottom view of the amplifier, in contrast to the power supply, shows the diligent use of point-to-point wiring for all signal carrying connections. Note that all components are rigidly fastened down rather than supported on thin leads.

means that the peak power is 400 watts for a steady sinusoidal signal. However, if only a short burst of sinusoidal signal is applied it is possible to obtain almost $(800/600)^2$ times this power, or about 700 watts. This latter figure might be called the instantaneous peak power.

Now it would be folly to try to rate all amplifiers according to the suggestions discussed above. Manufacturers have difficulty enough with the present sets of advertising claims. It is interesting to note, however, that a rating on the instantaneous peak power available is not completely ridiculous. (At least one manufacturer uses this rating technique.) If we consider normal music for example, we find that the ratio of the average to peak power required for undistorted reproduction is in the neighborhood of 10 to 20. This means simply that the loudest tones during a given interval which is not too long will require a 10 or 20 watt amplifier if the average level is 1 watt. The system is thus required to pass high power peaks for only very brief instants and can spend most of the time recovering from these peaks. All of this consideration would tend to indicate that any amplifier would perform slightly better under music or noise conditions than it does when sinusoidal signals are used to test it.

When we use a sinusoidal signal to test an amplifier which is designed to handle music, we are in fact using a signal which is as much unlike music as possible. The reason for using sinusoids, of course, is that it is easy to do and easy to obtain consistant and relatively interpretable results.

This effect became of interest in the present amplifier design because it is somewhat more exaggerated in this amplifier than in a normal low-power amplifier. If the voltage regulation on the power supply were perfect this effect would not appear and the steady-state peak power would be the same as the instantaneous peak power. This would be an ideal situation which can be achieved in low-power amplifiers rather easily by means of electronic regulation. In the case of a 600-volt 500-ma supply, the added complexity of electronic regulation becomes almost prohibitive.

The filtering shown in this design consists of 4 capacitors of 100 µf each connected in series-parallel to give an effective value of 100 µf at 900 volts maximum voltage. The choke-input filter with a swinging choke at the cathodes of the rectifiers gives as good regulation as one can expect for a simple rectifier-filter combination.

As far as the steady-state output of this amplifier is concerned, it will deliver 100-watts continuously. That is, for hours or even days at a time. It will deliver 200 watts for periods of a few minutes. Periods longer than ten minutes have not been tried. But the output tubes and power transformer warm up considerably after this time.

The distortion for the amplifier for several output levels is shown in *Fig.* 7. The distortion at high outputs is easily measurable and is found to lie at about the level anticipated in the specifications. At low outputs the distortion is below about 0.2 per cent and is impossible to measure with the equipment available to the author. It is in fact very difficult to measure distortion levels below 0.2 per cent because of the residual distortion in even the very best oscillators. Special filters are required for more accurate measurements and these can usually be made only at single frequencies. The noise output of the amplifier, which includes thermal noise and hum, is less than 500 µv at the 16-ohm tap of the output transformer. This is negligible and may be attributed to the very heavy filtering in the power supply and the high voltage on the output tubes.

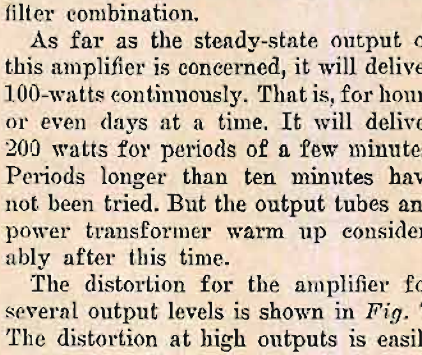

Fig. 6. Top view of the amplifier.

In conclusion, it is fair to say that the amplifier described here has been found to be a very reliable power source when driven by an oscillator for variable frequency applications as well as a very fine power amplifier for high-fidelity applications where extreme output is required. For the serious amateur it is a very useful addition to his stock of electronic tools. Æ

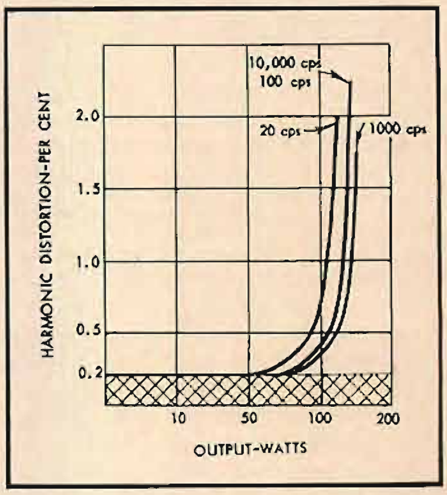

Fig. 7. Total harmonic distortion for several frequencies.

PARTS LIST

In addition to the standard parts which are shown in the schematic diagram, the following list gives the specifications for the transformers and filter chokes which may be replaced by equivalent types:

Output transformer		
Dynaco	A-450	
Power transformers		
UTC	S-46	2000-0-2000 volts, 300 ma
Triad	F-21 A	6.3 volts, 10 amp
Stancor	PM 8412	400-0-400 volts, 200 ma 5 volts, 3 amp 6.3 volts, 5 amp
Stancor	P 6134	6.3 volts, 1.2 amp
Filter Chokes		
Stancor	C 1002	15 henry, 75 ma
Stancor	C 1003	16 henry, 50 ma
Triad	C 33A	300 ma, 5/25 henry (swinging)
Triad	C 18A	300 ma, 8 henry
Relays		
Potter and Brumfield,	Type M LB-5	10,000-volt plate relay
Potter and Brumfield,	Type KA11AY	110 volt d.p.d.t.
Potter and Brumfield,	Type KL11A	110 volt d.p.d.t.
Amperite	115NO30T	time delay relay

Another Power Amplifier!

R. A. GREINER*

Here's an amplifier that will loaf through the task of providing music throughout the house—and outdoors too. Also the distortion is extremely low.

The readers first reaction to this article on power amplifiers might very well be, as the title indicates, "Another power amplifier!" Still there are worth-while and interesting things to talk about with respect to vacuum-tube amplifiers. The amplifier described here and some of the design problems are just a bit unusual. In the first place, this is a very high-power amplifier in terms of the power levels which are usually used in high-fidelity systems. The amplifier itself is a relatively straightforward combination of well-tested audio circuits which have been presented in the literature over the years by various authors. This might well be the last of the vacuum-tube amplifiers as far as this writer is concerned. Perhaps a brief explanation of that last statement is in order.

For many years now it has been relatively easy to build essentially distortionless power amplifiers in the 50 or even 100-watt size. The only challenge has been to do it with fewer tubes, at smaller cost, and in the smallest possible space. It would seem that the next logical step would be to completely transistorize the power amplifier and thus make it even smaller and presumably more reliable. It is certainly a worthwhile goal—but it is also very difficult. In fact, at the present state of the transistor art it is very expensive to make relatively high-powered amplifiers with wide frequency response and low distortion.

In the case of the amplifier to be considered here, it was felt that the vacuum tube could be used with standard components to give the required design characteristics in the quickest time and with the least amount of effort. There was need for an amplifier which would deliver 100 to 150 watts under continuous duty sinusoidal output over the entire range from 20 cps to 20,000 cps. This requirement plus the inherent challenge presented by designing and constructing a really good high-power amplifier are the primary reasons for the existence of the amplifier design and design discussion which follows.

The final specifications which were set down for the amplifier are summarized as follows: Power output 120 watts continuous duty, frequency range 20 cps to 20,000 cps, 200 watts for short periods (5 minutes at a time), less than 2 per cent total harmonic distortion at 200 watts and less than 0.5 per cent at 100 watts (over the entire frequency range). These goals were attained in the amplifier described here. More detailed performance characteristics are given at the end of this article.

This amplifier is of course much larger than would ever be required in even the largest home audio system contained in a single listening room. There are uses for such an amplifier in addition to those which led to its construction however. For example, it is very useful as a central amplifier for distributing music to an entire house and garden where a large number of individual speaker systems are to be driven. It is also valuable for high-quality commercial sound distribution systems which carry music as well as voice. Even at a 50-watt average

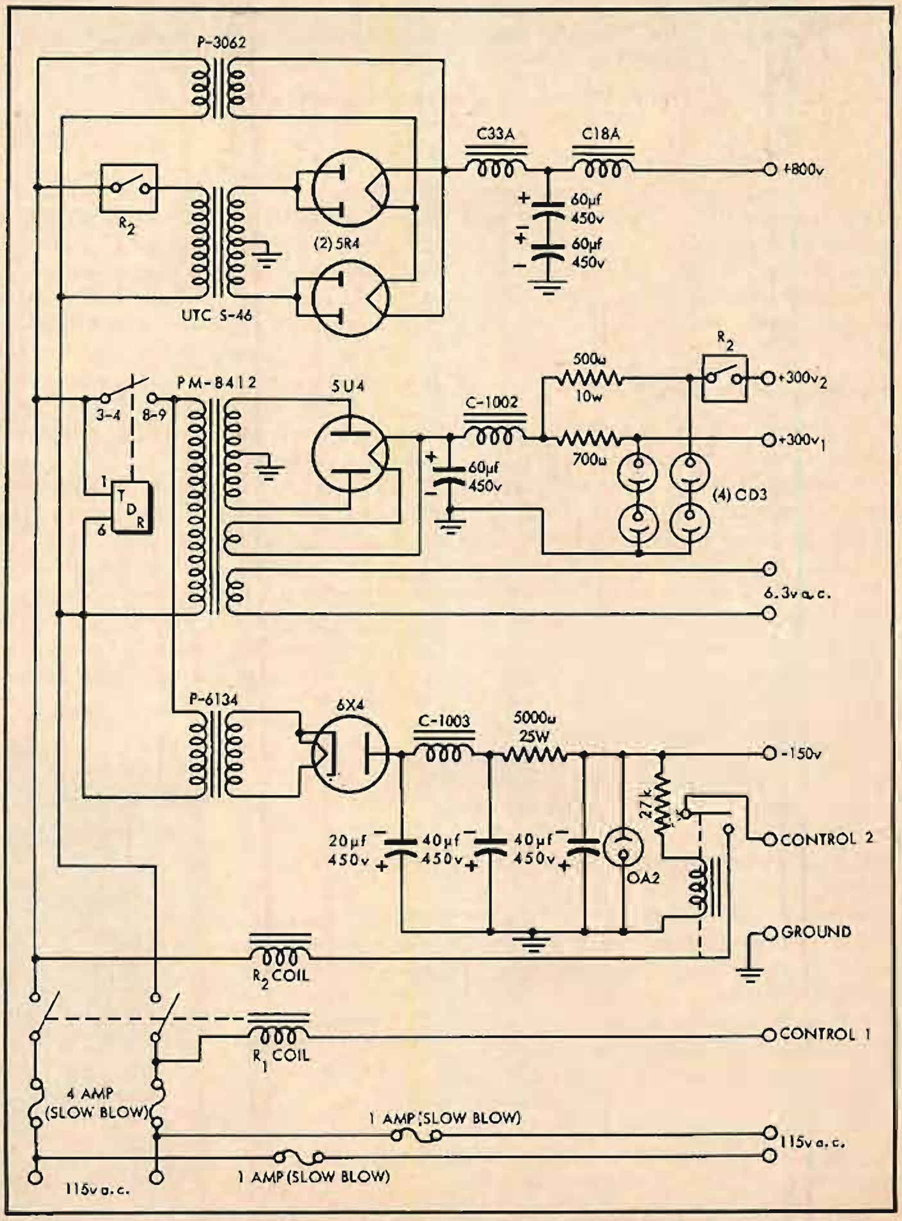

Fig. 1. Schematic diagram of the power supply.

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* *Department of Electrical Engineering, University of Wisconsin.*

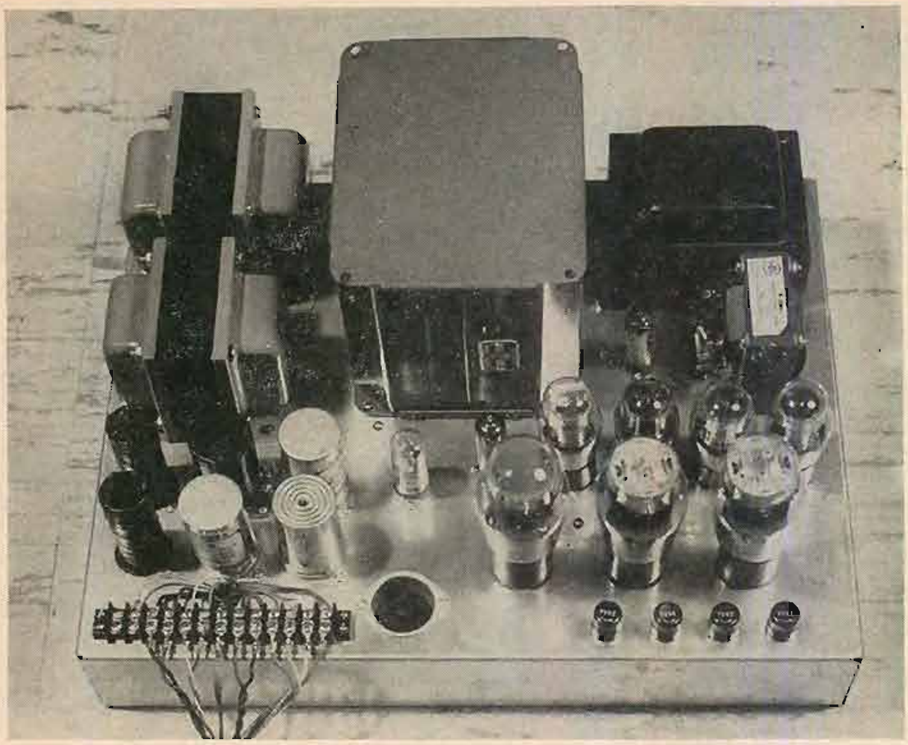

Fig. 2. Top view of the massive power supply.

level this amplifier is loafing along with plenty of reserve for the peaks. The peak output is 400 watts continuous wave or almost 600 watts on the instantaneous peak power basis described below.

Description of the Circuit

Turning first to a description of the circuit, we see in the power supply, *Fig.* 1, a relatively direct, though involved, circuit. There is a bit of complexity due to the need for provision to allow the output-tube filaments and the rectifier-tube filaments to warm up before the main power transformer is turned on. This delay is provided by a time delay relay which delays the turning on of both the 300 volt supply and the negative supply used for biasing the output tubes. Thus the filaments are allowed to warm up for a minimum of thirty seconds after the power switch is turned to the "on" or "standby" positions. Only after the negative supply has reached full voltage and the bias for the output tubes is supplied will the high voltage to the plates and the screens of the output tubes be turned on. The bias current through the plate relay operates a double pole relay which turns on the main high-voltage supply transformer and in addition connects the screen supply for the output tubes to the regulated 300-volt supply which is already in the standby condition. It is convenient to provide two power switches. One closes relay No. 1 which turns the bias supply and the 300-volt supply on. This is then the standby condition. The second switch is in series with the plate relay and thus can be used to override the turning on of the main power if desired. In cases where no long periods of standby operation are required, the second switch may be eliminated and the normal turn-on sequence will be followed each time the amplifier is turned on. The completed power supply is shown in *Fig.* 2 and *Fig.* 3. The chassis is made of aluminum and is a standard 13 × 17 × 3-in. in size. A large amount of filtering is used to keep the total hum in the amplifier to very low levels. In addition, a choke-input filter is required for the main plate supply because the power transformer is is used very near its maximum ratings at the continuous output rating of the amplifier. The main power transformer, UTC S-46, will deliver 300-ma continuously which is enough for 100-watts output. At the 200-watt level, however, the amplifier requires 500 ma. This transformer will supply this current for short periods without difficulty. If continuous operation at 200 watts is required, it would be necessary to use a somewhat larger power transformer.

The driver sections of the amplifier are supplied with 300 volts from a pair of regulators. Two VR-150 voltage regulators are used in series for the driver stages and a second pair similarily connected are used for the screen supply. There is a considerable variation of the screen current in the output tubes as the amplifier is driven from quiescent to full output and hence regulation is almost essential for the screen supply.

The negative supply should, of course, be regulated since the biasing of the output tubes is critical for long-term low-distortion operation. In the present amplifier a single OA2 is used for this purpose with the power supplied by one side of the 300-volt supply transformer through a separate rectifier tube. A separate filament transformer is necessary to avoid any heater-to-cathode voltage difficulties in the 6X4 rectifier.

The power amplifier schematic is shown in *Fig.* 4. Notice that the filament transformer for the output tubes is on this chassis to avoid running the high current required for the tubes through a long connecting cable. The total current required for the output tubes is 6.4 amperes. The filament power for the driver and input stages is taken from a separate transformer winding because it was at first thought necessary to bias the filaments at some d.c. potential with respect to ground. This later turned out to be unnecessary so that they may be connected to the same transformer which supplies the output tubes.

All components are standard. Notice

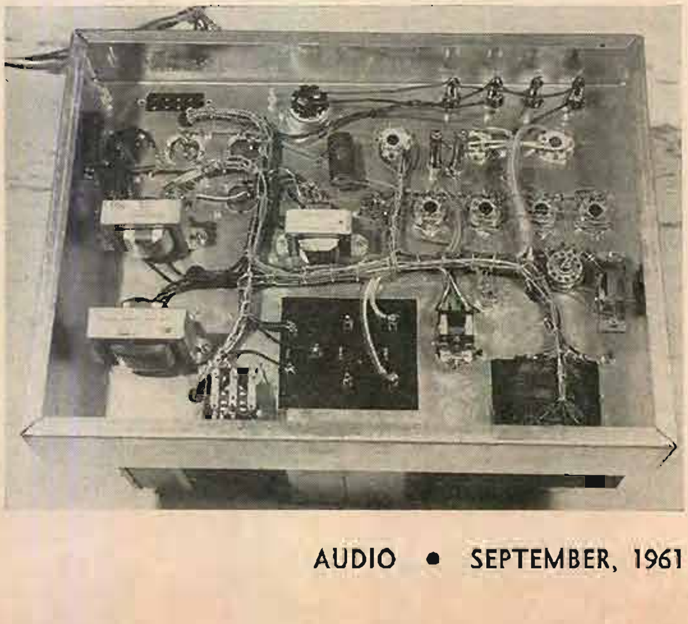

Fig. 3. Neat, cabled wiring as shown is best practice for the power-supply portion of any amplifier.

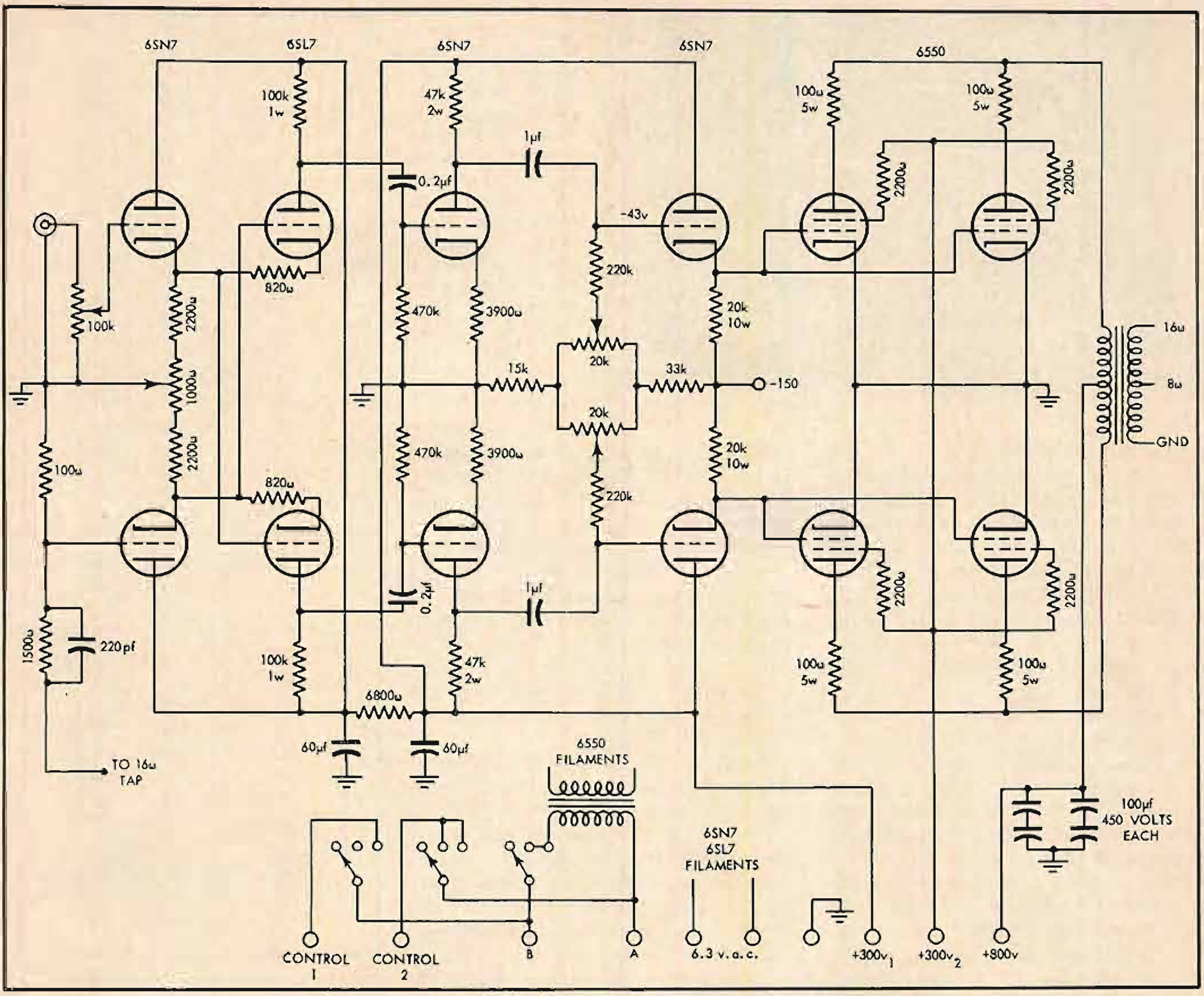

Fig. 4. Schematic diagram of the power amplifier

that there are only four capacitors in the entire amplifier. The high value coupling capacitors are physically quite large unless the "metallized" type is chosen. These may be seen in the photograph of the underside of the amplifier shown in *Fig.* 5. Straight point-to-point wiring is used throughout the amplifier. Good sturdy hook-up wire going from point-to-point and covered with spaghetti will hold its shape and give a neat and permanent job. Several capacitors which were added after the amplifier was completed can be seen on the underside also. These would be more conveniently mounted on the top. They should be protected from the direct radiation from the output tubes, however, since excess heat may be harmful to them. A pair of 20,000-ohm potentiometers are used to adjust the bias on the output tubes to an optimum value. A 1,000-ohm resistor is used for balancing the drive. Adjustment is best achieved by means of distortion measurements, but it is not very critical. Particular care should be taken with the output-transformer leads since they are at high potential and have 1200-volt peak-to-peak signals appearing on them at full output.

The bias voltage at the grids of the output tubes will be about −43 volts. The driver stage is capable of about 140 volts peak-to-peak drive and will thus drive the output stage slightly into the grid conduction region at full output. This will not cause trouble however, since the grids are cathode driven and there is no recovery time involved for bias changes which would normally take place if the output tubes were capacitor coupled to the driver stage. The output clips smoothly and there is no measurable recovery time from even extreme overload. Recovery time from ten times overdrive to one tenth maximum output is less than one cycle at 20,000 cps. Absolutely no signs of high-frequency oscillation or low-frequency instability are present under any signal conditions.

The regulation of the high-voltage supply will have a rather interesting effect on the maximum power output capabilities. The power available for steady-state operation is not as high as it is for sudden short impulses or bursts of sinusoidal signal. Thus one finds that there are different ratings possible for a power amplifier, depending upon the test procedure used. To clarify this problem, consider the following situation. Using the present amplifier as an example, we find that the power supply voltage is 800 volts with no signal, or with a very small signal, but that it drops to 600 volts at the 200-watt level. This drop in voltage does not occur immediately. If the capacitors which are used to filter the plate supply are very large as they are in this amplifier, it will take as long as 1/10 second to drop if full power is suddenly called for. Since the maximum power output possible depends on the plate voltage supply we find that the amplifier will supply considerably more than the steady-state power for a few cycles of applied signal even at low frequencies. The steady-state power in this case is 200-watts rms. This

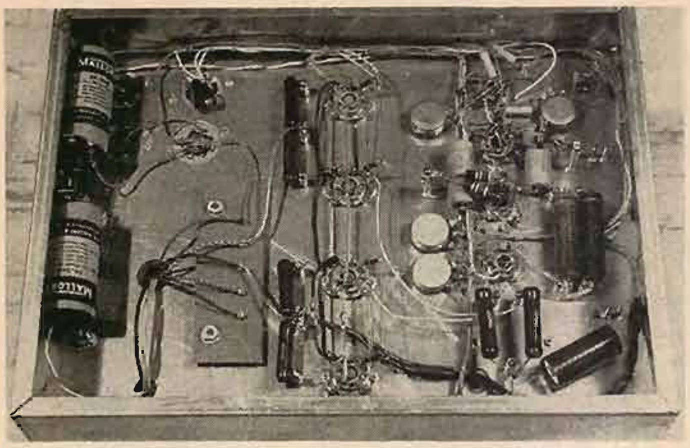

Fig. 5. Bottom view of the amplifier, in contrast to the power supply, shows the diligent use of point-to-point wiring for all signal carrying connections. Note that all components are rigidly fastened down rather than supported on thin leads.

means that the peak power is 400 watts for a steady sinusoidal signal. However, if only a short burst of sinusoidal signal is applied it is possible to obtain almost $(800/600)^2$ times this power, or about 700 watts. This latter figure might be called the instantaneous peak power.

Now it would be folly to try to rate all amplifiers according to the suggestions discussed above. Manufacturers have difficulty enough with the present sets of advertising claims. It is interesting to note, however, that a rating on the instantaneous peak power available is not completely ridiculous. (At least one manufacturer uses this rating technique.) If we consider normal music for example, we find that the ratio of the average to peak power required for undistorted reproduction is in the neighborhood of 10 to 20. This means simply that the loudest tones during a given interval which is not too long will require a 10 or 20 watt amplifier if the average level is 1 watt. The system is thus required to pass high power peaks for only very brief instants and can spend most of the time recovering from these peaks. All of this consideration would tend to indicate that any amplifier would perform slightly better under music or noise conditions than it does when sinusoidal signals are used to test it.

When we use a sinusoidal signal to test an amplifier which is designed to handle music, we are in fact using a signal which is as much unlike music as possible. The reason for using sinusoids, of course, is that it is easy to do and easy to obtain consistant and relatively interpretable results.

This effect became of interest in the present amplifier design because it is somewhat more exaggerated in this amplifier than in a normal low-power amplifier. If the voltage regulation on the power supply were perfect this effect would not appear and the steady-state peak power would be the same as the instantaneous peak power. This would be an ideal situation which can be achieved in low-power amplifiers rather easily by means of electronic regulation. In the case of a 600-volt 500-ma supply, the added complexity of electronic regulation becomes almost prohibitive.

The filtering shown in this design consists of 4 capacitors of 100 µf each connected in series-parallel to give an effective value of 100 µf at 900 volts maximum voltage. The choke-input filter with a swinging choke at the cathodes of the rectifiers gives as good regulation as one can expect for a simple rectifier-filter combination.

As far as the steady-state output of this amplifier is concerned, it will deliver 100-watts continuously. That is, for hours or even days at a time. It will deliver 200 watts for periods of a few minutes. Periods longer than ten minutes have not been tried. But the output tubes and power transformer warm up considerably after this time.

The distortion for the amplifier for several output levels is shown in *Fig. 7*. The distortion at high outputs is easily measurable and is found to lie at about the level anticipated in the specifications. At low outputs the distortion is below about 0.2 per cent and is impossible to measure with the equipment available to the author. It is in fact very difficult to measure distortion levels below 0.2 per cent because of the residual distortion in even the very best oscillators. Special filters are required for more accurate measurements and these can usually be made only at single frequencies. The noise output of the amplifier, which includes thermal noise and hum, is less than 500 µv at the 16-ohm tap of the output transformer. This is negligible and may be attributed to the very heavy filtering in the power supply and the high voltage on the output tubes.

In conclusion, it is fair to say that the amplifier described here has been found to be a very reliable power source when driven by an oscillator for variable frequency applications as well as a very fine power amplifier for high-fidelity applications where extreme output is required. For the serious amateur it is a very useful addition to his stock of electronic tools. Æ

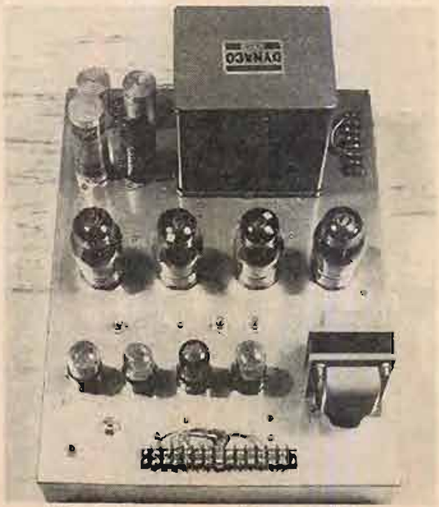

Fig. 6. Top view of the amplifier.

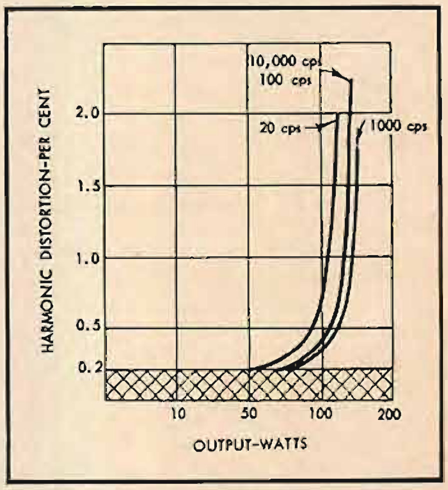

Fig. 7. Total harmonic distortion for several frequencies.

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Potter and Brumfield,	Type KL11A	110 volt d.p.d.t.
Amperite	115NO30T	time delay relay

Performance of Series-Parallel Speaker Arrays

JAMES F. NOVAK*

While multiple-speaker systems may have a large popular appeal, a thorough study of the theoretical aspects of speaker arrays may give rise to the certainty that such popularity is largely due to subjective listening.

Loudspeaker arrays consisting of inexpensive replacement type speakers continue to receive more and more attention judging by the number of "do-it-yourself" articles that have appeared in various publications over the past year.[1, 2, 3, 4, 5] That the audiofan imagination is being excited is in no small way related to the extraordinary performance claims made for these systems. Typical claims for arrays of 16, 22, and 32 loudspeakers in the $2–3 price class are: measured response essentially flat from at least 20 cps to 10,000 or 15,000 cps depending upon the quantity of speakers used, absence of cone resonance, superior transient response, extremely low distortion, freedom from coloration, efficiency gains of as much as 30 db at 20 cps, and others too numerous to mention.

A typical $2–3 loudspeaker has a diameter of five or six inches, a 0.68-oz. magnet with 9/16-in. voice coil, 100–150 cps resonance, 4–5 watt power-handling capability, piston-band efficiency of one per cent or less and reasonably acceptable response to about 7000 cps.

None of the authors have offered any acceptable explanation of why by using "many" of these speakers in series-parallel combinations, these unpretentious performance specs are transformed into something that rivals and exceeds the performance of the finest, largest, and most expensive three- and four-way horn-loaded systems.

One can only conclude from the brief explanations offered, that all improvements are in some way related to the small fraction of total input power supplied to each speaker, the resulting small voice coil travel which enables the voice coils to remain in "linear magnetic fields," or perhaps because that while the cones act together as if they were one huge speaker at low frequencies, high efficiency is maintained because each cone has low mass.

A consideration of the acoustics of array design plus careful measurements and evaluation leads to the conclusion that most of the claims are based upon rather careless subjective evaluations. It is the purpose of this article to examine the physics of arrays, measure the performance of a particular array, and derive conclusions therefrom.

LOUDSPEAKER PERFORMANCE

Response

A frequency-response curve of a loudspeaker is the variation in either sound pressure or acoustic power as a function of frequency, with the voice coil voltage generally specified as held constant.

The acoustic power radiated from the front of the loudspeaker is:

$$P = |v_c|^2 R_{mr} \qquad = \left| \frac{e_g Bl}{R_c \sqrt{R_m^2 + X_m^2}} \right|^2 R_{mr}$$

where v_c is the voice coil velocity and R_{mr} the radiation resistance.

The quantity $\sqrt{R_m^2 + X_m^2}$ in the denominator is frequency dependent as is the radiation resistance, R_{mr}, in the numerator which varies as the square of the frequency. The variation in sound pressure due to the variable denominator is exactly the same as the variation of electrical current in a series *RLC* electrical resonant circuit.

A universal resonance curve, (A) of *Fig.* 1, is a plot of this current variation as a function of normalized frequency. It has a slope of +6 db per octave of frequency below resonance and a slope of −6 db per octave above resonance.

The radiation resistance has a slope of +6 db below and above resonance. This serves to further increase the slopes of the universal resonance curve which is representing the voice-coil velocity so that below the resonance frequency the slope is +12 db per octave and 0 db

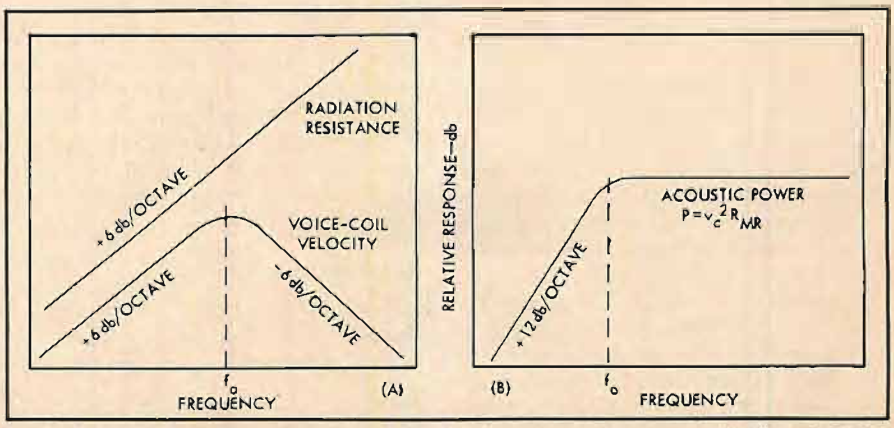

Fig. 1. Universal resonance curve (A) for loudspeakers showing radiation resistance and voice-coil velocity with respect to relative response. (B) shows acoustic power output plotted against relative response.

---

* *Sr. Design Engineer, Jensen Manufacturing Co., Chicago, Ill.*

[1] C. F. Mahler, Jr., "Hi-Fi Performance from Small Speakers." Audio, December, 1959.

[2] C. F. Mahler, Jr., "The Series-Parallel Speaker Array," Audio, November, 1960.

[3] C. F. Mahler, Jr., "Multiple Speakers," Letter to Editor, Audio, p. 6, January, 1961.

[4] J. Kyle, "Sweet Sixteen," *Popular Electronics*, January, 1961.

[5] J. Kyle, "Sweeter with a Tweeter," *Popular Electronics*, April, 1961.

(flat) above resonance, as in (B) of *Fig.* 1. This curve now represents the acoustic power *vs.* frequency-response curve of the speaker. It can be readily seen from this curve that the resonance frequency determines the low-frequency cutoff of a simply baffled loudspeaker. Only a decrease in resonance frequency or a modification in the slope of the radiation resistance (such as by horn loading) can lower the low-frequency cutoff of the speaker.

The preceding statements concerning the relationship between low-frequency cutoff and speaker resonance are somewhat oversimplified because they ignore the damping (or Q) at resonance. Q is defined as

$$Q = \frac{2\pi f_o M_m}{R_m}$$

where f_o is the resonance frequency, M_m is total mass and R_m the total mechanical resistance. *Figure* 2 shows the variation in power output as a function of frequency for various values of Q. The most desirable value of Q would lie between 1.0 and 0.5. Values less than this increase the effective cutoff considerably above resonance and values greater than 1.0, while extending the cutoff, create a "boom" at resonance. The typical \$2–3 speaker has a Q of about 3. This can be reduced by decreasing the resonance frequency, by decreasing the mass, or by increasing the radiation resistance.

Efficiency

Any cone-type loudspeaker can be designed to provide uniform response over a moderate frequency band. Practical limitations, however, severely restrict uniform reproduction over a wide frequency range. The two ends of the audio-frequency spectrum are the most difficult to reproduce with efficiencies comparable to those readily obtained in the mid-frequency range. Besides the restrictions imposed by the resonance frequency, inefficiency at low frequencies is also due to the small value of radiation resistance. A large radiation resistance may be obtained by using a large cone since radiation resistance is a function of the square of the cone area.

The high-frequency efficiency of a cone-type loudspeaker is limited by the mass reactance of the vibrating system. One obvious way to improve the high-frequency efficiency is to decrease the mass of the vibrating system. A simple means for accomplishing this is to use a small cone.

There are several other methods for extending the range such as the use of a horn or bass-reflex enclosure for low-frequency extension and separate loudspeakers or dual cones driven by a single voice coil for high-frequency extension. These, however, will not be considered here.

Directional Pattern

The directional pattern of a cone-type loudspeaker depends primarily upon the cone diameter and frequency, although the cone angle, paper pulp, and voice-coil diameter also exert an influence.[6] Because diameter and frequency are the most important factors, the directional patterns can be approximated satisfactorily by those of a vibrating piston of the same diameter. These show that the radiation becomes highly directional at frequencies for which the cone diameter is greater than one wavelength. In other words, for any given frequency, a small-diameter cone will have a broader directional pattern than a large-diameter cone.

Transient Distortion

A transient is a waveform, usually with a steep wavefront, which does not repeat at a periodic interval. Any sudden commencement or cessation of a periodic wave contains a transient component. For reproduction without distortion, the acoustical waveform must reproduce faithfully the input waveform.

An important factor determining the transient response of a loudspeaker is the amount of damping of the loudspeaker cone. A statement of Q generally describes the amount of damping at the fundamental resonance but not elsewhere. A loudspeaker cone is a multi-resonant device at the higher frequencies and vibrates in parts. Each of the higher-order cone resonances has associated with it a transient decay time that can be reduced to acceptable limits by adding damping through proper choice of cone material and treatment. A substantial increase in radiation resistance would also help to increase damping and thereby reduce transient distortion.

Studies by Larson and Adducci[7] show that an important requirement for good reproduction of transients is a smooth frequency response characteristic free from sharp peaks and dips. Loudspeakers with smooth response characteristics always have less transient distortion than those with sharp peaks or dips. They conclude, however, that transient distortion in loudspeakers is of minor importance at the higher frequencies because the decay constant of most rooms is considerably greater than that of the loudspeaker.

Harmonic Distortion

Examination of the force-displacement characteristic of a typical loudspeaker of the type under consideration shows that the suspension system is linear only for small amplitudes and becomes quite non-linear for large amplitudes. The result of a non-linear cone suspension is the production of odd order harmonics when the voice coil is excited with a sinusoidal input.

Another source of distortion is a non-uniformity of the flux density through which the voice coil has to move. The driving force is produced by current in the voice coil interacting with the magnetic field. This force will not be proportional to the current if the magnetic field encountered by the voice coil varies with the position of the voice coil. The result will again be the production of harmonic distortion. This type of distortion becomes serious only when the cone amplitude is sufficient to cause the voice coil to move out of the air gap.

FM and IM Distortion

Two other forms of distortion are frequency modulation and intermodulation distortion. These are sometimes mistaken for each other.

If the cone is radiating both a high- and a low-frequency wave, the high-frequency energy will be modulated by the low-frequency wave. The resulting wave can be resolved into a carrier (the high frequency) and side bands (the intermodulation frequencies) plus the low-frequency input. This type of distortion, known as frequency modulation, is quite small below 1000 cps and becomes significant only at higher frequencies when the low-frequency amplitude of the cone is very large.[8]

Intermodulation distortion is one of the effects of non-linearity when more than one input frequency is applied. It becomes evident in two forms, amplitude modulation of one frequency by another and the production of sum and difference frequencies.

If a loudspeaker with a non-linear cone system is reproducing two frequencies, the higher frequency can become amplitude modulated by the lower frequency and create a displeasing tremulo effect.

The most serious form of intermodulation distortion is the formation of sum and difference frequencies.[9] These frequencies are normally inharmonic and can create serious distortion sometimes described as harsh, buzzy, or rough.

The amplitude of the cone movement is inversely proportional to the square of the frequency for a constant sound power output. Consequently, much of the distortion will be confined to the low-frequency range since the non-linearities are manifested when the amplitude or excursion of the cone is large.

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[6] H. F. Olson, *"Acoustical Engineering,"* D. Van Nostrand Co., Inc., p. 35, 1957.

[7] R. J. Larson, A. J. Adducci, "Transient Distortion in Loudspeakers," presented at IRE Convention in New York, March, 1961.

[8] H. F. Olson, *"Acoustical Engineering,"* D. Van Nostrand Co., Inc., p. 190, 1957.

[9] *"Radiotron Designer's Handbook,"* Ch. 14, p. 611, 1953.

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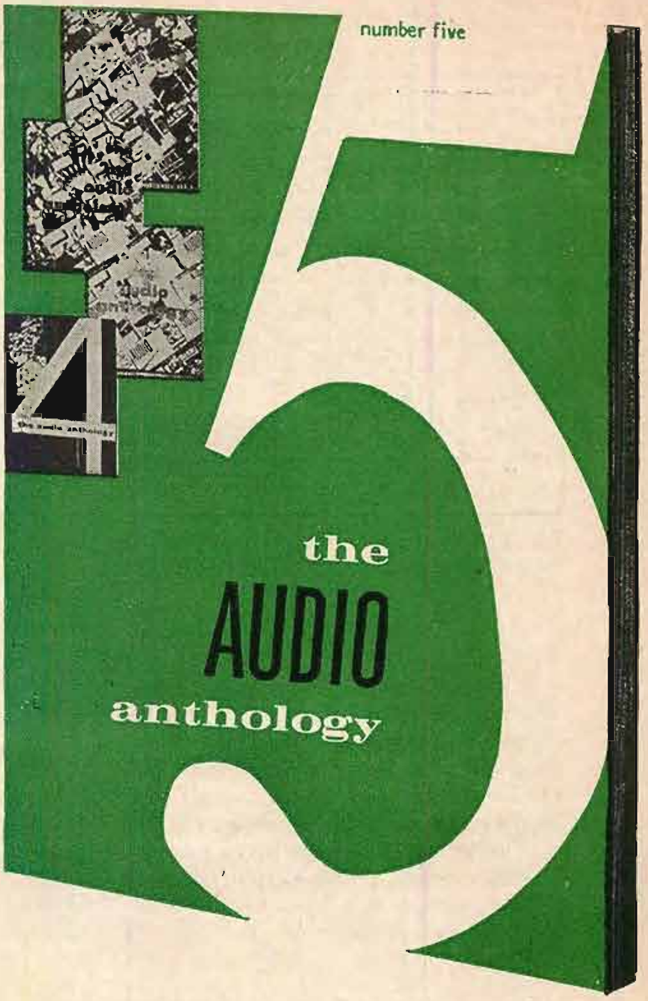

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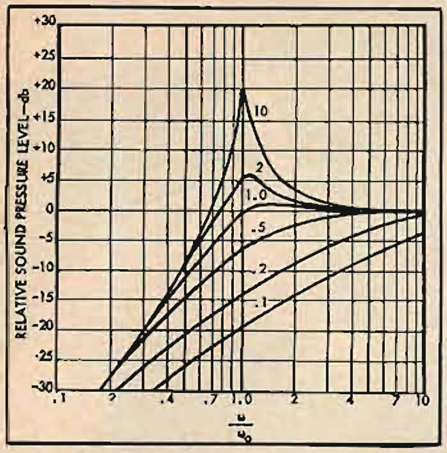


Fig. 2. Sound-pressure-level response of direct radiator loudspeaker in an infinite baffle or closed box.

A loudspeaker cone must move a definite amount of air in order to produce a given sound pressure level at a given frequency. Obviously, a large cone will not have to move as far as a small cone in order to move the same amount of air, or to be more correct, to produce the same sound power output. Because of these smaller amplitude requirements, the large cone speaker has the inherent ability to produce less distortion than a small speaker since it can operate in the region of linear excursion.

A consideration of all of the facts presented seems to create a paradox. Good low-frequency reproduction demands large diameter cones but at the same time, the large diameter and resulting large mass become two important deterrents to a flat response at the high frequencies. The high mass causes a drastic reduction in efficiency in the high-frequency range. Furthermore, the directional pattern of a large cone becomes very narrow in the high-frequency range. Broad directional patterns require the use of cones of rather small diameter.

The situation of a large number of small loudspeakers operating in unison now begins to look attractive. Each loudspeaker will be required to handle only a small fraction of the total input power and hence will operate in the more linear region since the amplitude will be small. Because the effective cone area is increased in direct proportion to the number of speakers used, the requirement of large cone area is also satisfied. One may reason intuitively that the radiation resistance will increase as the square of the effective cone area. This should result in an efficiency increase. It would appear on the surface that a large array of small loudspeakers could overcome the performance limitations of single loudspeakers. The validity of this statement can best be determined quantitatively by comparing the performance of an inexpensive six-inch loudspeaker with a 32-speaker array of six-inch speakers and a commercial 3-way high-fidelity system with a cost similar to that of the array. The particular speakers compared are a Jensen 6J6 (cost—\$2.61), a 30″ × 60″ array of 32 Jensen 6J6's (cost—\$83.52), and a Jensen TF-3 (cost—\$79.50). The enclosure volume was about eight cubic feet for both the single 6-in. speaker and the array, and 1.5 cubic feet for the TF-3. The speaker complement in the TF-3 consists of a single 10-in. high-excursion, high-compliance Flexair woofer, two 3½-in. tweeters and one spherical-dome type super tweeter. The enclosure is vented through a 3-in. tube 7½ in. long.

Particular points of comparison are those previously discussed, i.e., response, efficiency, directional pattern, transient distortion, harmonic distortion, frequency modulation, and intermodulation distortion.

THE MULTIPLE SPEAKER ARRAY

An examination of the mechanical circuit of an array consisting of *N* loudspeakers reveals that (mechanically) all of the speakers appear in parallel regardless of their electrical connections. An interesting result of this fact is that the array can be represented by a single speaker of *N* times the area, *N* times the mass, *N* times the mechanical resistance (losses) and *N* times the suspension stiffness. The value of the voice-coil resistance would range from *N* to *1/N* times depending upon whether the speakers were electrically connected in series, parallel, or combinations thereof. It would appear that the fundamental resonant frequency and *Q* (damping) of the equivalent loudspeaker would remain the same as that of any one of the speakers comprising the array—assuming that they were all identical.

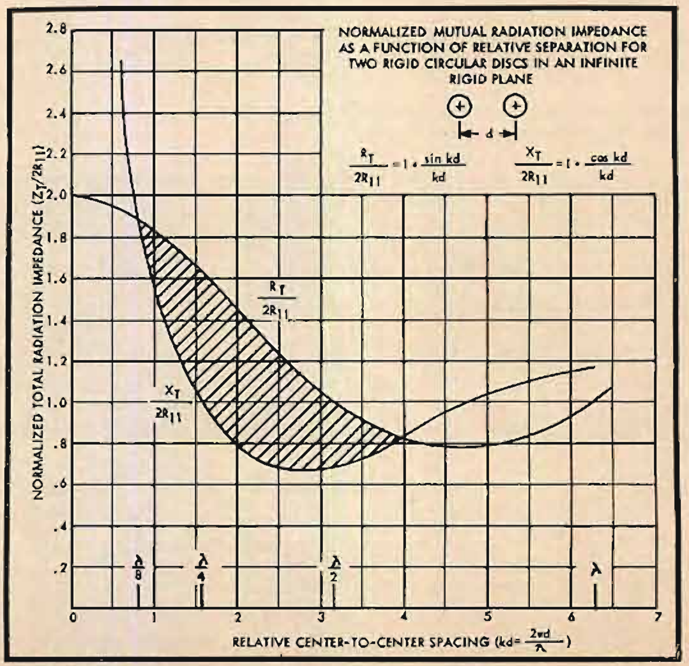
Actually, the mechanical circuit does not show the effects of acoustic interaction between the speakers. A quantitative investigation of this acoustic interaction is outside the scope of this paper. It will suffice to use the results of Pritchard's work on the mutual acoustic impedance between radiators.[10]

The net radiation resistance, or acoustic loading for small spacings in an *N* speaker array, is N^2 times as large as the loading on a single speaker. This increase is consistent with an *N-fold* increase in cone area. On the other hand, as the relative center-to-center spacing (ratio of spacing to wavelength) is increased, the sound pressure no longer remains uniform over the array surface. This causes the array loading to decrease ultimately to *N* times the loading on a single speaker. Increased loading, in this case, occurs only in direct proportion to the total cone area because the over-all array dimensions are now large relative to a wavelength.

Figure 3 illustrates this behavior. No loss in generality results even though this is a plot of the total radiation impedance for only two discs. For the most general type of array, the mutual radiation impedance between any two speakers will be a function only of those two elements, independent of all others. It is sufficient, therefore, to calculate the mutual impedance between only two speakers at a time.

Examination of the reactive term plotted in *Fig.* 3 reveals that the mass

Fig. 3. Normalized mutual radiation impedance as a function of relative separation for two rigid circular discs in an infinite rigid plane.



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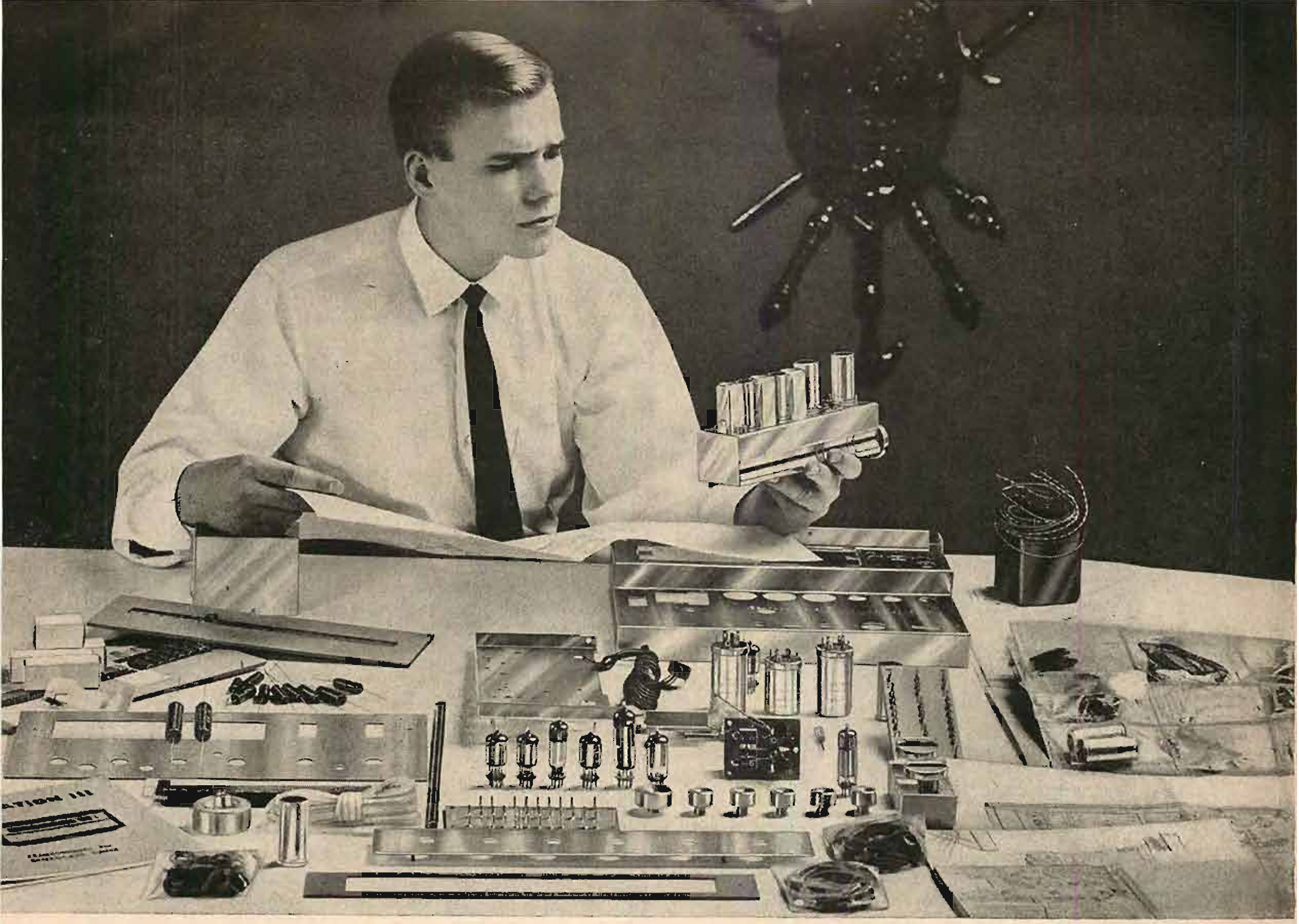
[10] R. L. Pritchard, *J. Acous. Soc. Am.*, Vol. 32, No. 6, pp. 730–737, June, 1960.



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The Citation III

Build the Very Best **CITATION KITS** *by* **harman kardon** reactance of the air load increases rapidly below frequencies for which the center-to-center spacing is less than a quarter wavelength. This could result in an appreciable increase in total moving-system mass at the low frequencies. It is interesting to note that the total mass of the air load actually becomes less than the air load on one speaker operating alone above the frequency range for which the center-to-center spacing is greater than a quarter wavelength. However, for spacings slightly beyond one wavelength, the magnitudes of mutual resistance and reactance become less than 10 per cent of the self-radiation resistance and reactance. It is now a relatively simple matter to investigate the performance of the array by employing the concept of the equivalent loudspeaker and keeping in mind the behavior of the radiation impedance.

Resonance and Damping

Figure 3 showed that at low frequencies, the mass of the air load increased over that which might be expected from a simple area increase. This will result in a decrease in the fundamental resonance of the loudspeakers because the mass of the air load is an appreciable part of the total moving-system mass. In the particular case of 32 six-inch speakers, the resonance decreased from 126 cps to about 90 cps. This represents a two-fold increase in total mass. The region of operation would be at about $kd = 0.5$ in *Fig.* 3.

The Q or damping at resonance will generally remain about the same as for a single speaker. The Q of the 32 speaker array remained at about 3—the same as for a single speaker. The reason for this is that while the increased radiation resistance tends to increase damping, the increased mass will to a great measure negate the increase. This represents about the worst possible situation. The damping can increase in some situations.

An improvement in damping can be obtained by employing speakers with staggered fundamental resonances. The normal production tolerances of ±10 per cent, however, result in an inadequate spread. Mr. Briggs, in his book "*Sound Reproduction,*" mentions a staggering of 20 cps. What really is involved here is the difference in terms of an octave, not in terms of cycles per second. Take, for example, two speakers —one with a resonance at 50 cps and another with a resonance at 70 cps. This spread represents one half of an octave in this frequency range. Applying this same spread (20 cps) to the Mahler system, for example, we find that this represents about one fifth of an octave. A 5-cps spread would represent only one seventeenth of an octave in this frequency range. The resonance spread of the speakers used in making these measurements was about 20 cps, and was inadequate to produce any significant increase in damping. If these speakers had resonances in the 50- to 70-cps range, some increase in damping would have resulted. However, the average person will not be able to walk into a store and select resonances.

We have assumed thus far that the cabinet had no effect upon the fundamental resonance of the speakers. This was a valid assumption so long as the speaker cabinet was not totally enclosed. Speaker resonance increases, however, when the speaker is placed in a totally enclosed cabinet due to the stiffness of the air volume in the box. The resonance frequency increases still more when two speakers are placed in the same cabinet because each speaker sees only half the volume. Further increases occur when four speakers are used since each speaker now sees only one-quarter the volume and so on. Each resonance increase is accompanied by a decrease in output below the fundamental resonance. These losses tend to nullify any gains due to mutual coupling between the speakers. The fundamental resonance of the 32-speaker array increased from 90 cps with the back of the cabinet open to about 250 cps when the back of the cabinet was completely closed. This increase when compared to the 126 cps resonance of a single speaker, represents almost a four-fold increase in total stiffness. The Q again remained at about 3.

Efficiency and Response

It was previously shown that the radiation resistance of the array increased as the square of the number of speakers when the spacing was small relative to a wavelength. One might erroneously conclude that the efficiency (or power radiated) would increase 6 db for each doubling of speaker complement. The total power input to the array divides equally among the speakers, however, causing the voice-coil velocity to decrease as the quantity of speakers is increased. The net result is an improvement of only 3 db for each doubling of the speaker complement.

A study of *Fig.* 3 reveals that the efficiency gains are restricted to a certain frequency range. Radiation resistance increases occur only at frequencies below which the center-to-center spacing is less than a half wavelength. Furthermore, the large increase in mass that occurs below frequencies for which the spacing is one-eight wavelength will tend to nullify any efficiency gains due to radiation resistance. This means that efficiency gains will be restricted to the band of frequencies for which the spacing is $\lambda/8$ to $5\lambda/8$. This region is indicated by the shaded area of *Fig.* 3. The frequency of maximum efficiency might be expected to occur at a center-to-center spacing of $\lambda/4$.

Applying this hypothesis to the array of 32 six-inch speakers, we find that efficiency gains should be expected over the frequency range of about 200 to 1000 cps. Maximum efficiency should occur at about 400 cps. This fact is in direct conflict with the popular notion that the maximum efficiency gains occur in the region of 20 cps.

A brief examination of the high-frequency performance of the array also reveals some interesting facts. Efficiency increases cannot occur because increased acoustic loading occurs only in direct proportion to the active area. How is it then that the high-frequency response is improved? The answer is that it is not. On the contrary, high-frequency response may possibly become poorer.

This occurs because the array cannot even begin to approximate a point source. It instead begins to act like a large rectangular piston consisting of a finite number of vibrating elements. The sound pressure at any point in front of the array will be a function of the average distance from the elements, the amplitude of vibration and the average difference of arrival time (phase) of sound from one element with respect to another. Some degree of destructive interference can be expected at all locations when the array dimensions become large due to the phase differences of the sound waves arriving by different path lengths.[11]

Figure 4 shows the sound pressure frequency response of a single six-inch speaker, an array of 32 six-inch speakers in a totally enclosed cabinet, the same array with the back removed and the response of the small bookshelf system previously described.

These measurements indicate negligible efficiency improvements below 100 cps for the closed-back array. A maximum efficiency improvement of about 13 db appears in the 400-cps region as predicted. This compares favorably with the theoretical maximum gain of 15 db which might be expected from an array of 32 speakers.

Except for a definite improvement in output below 100 cps, the response of the same array with the back removed is quite similar. It should be emphasized that the improvement below 100 cps is due mainly to the decreased fundamental resonance of the speakers rather than

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[11] Joel Julie, "Minimizing Interference Effects in Tweeters and Tweeter-Woofer Combinations," AES Preprint No. 142, 1960.

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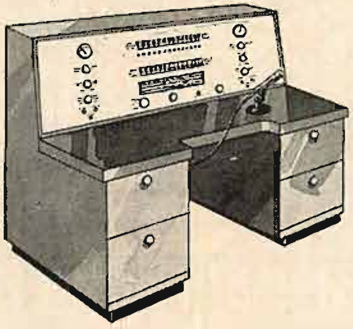

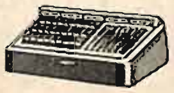

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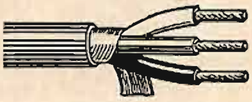
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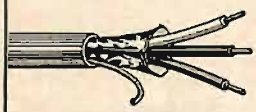
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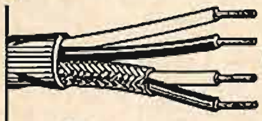
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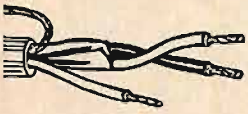
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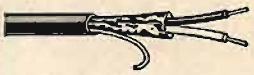
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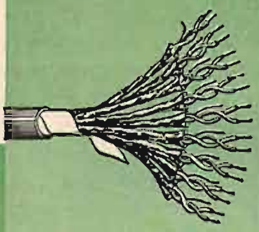

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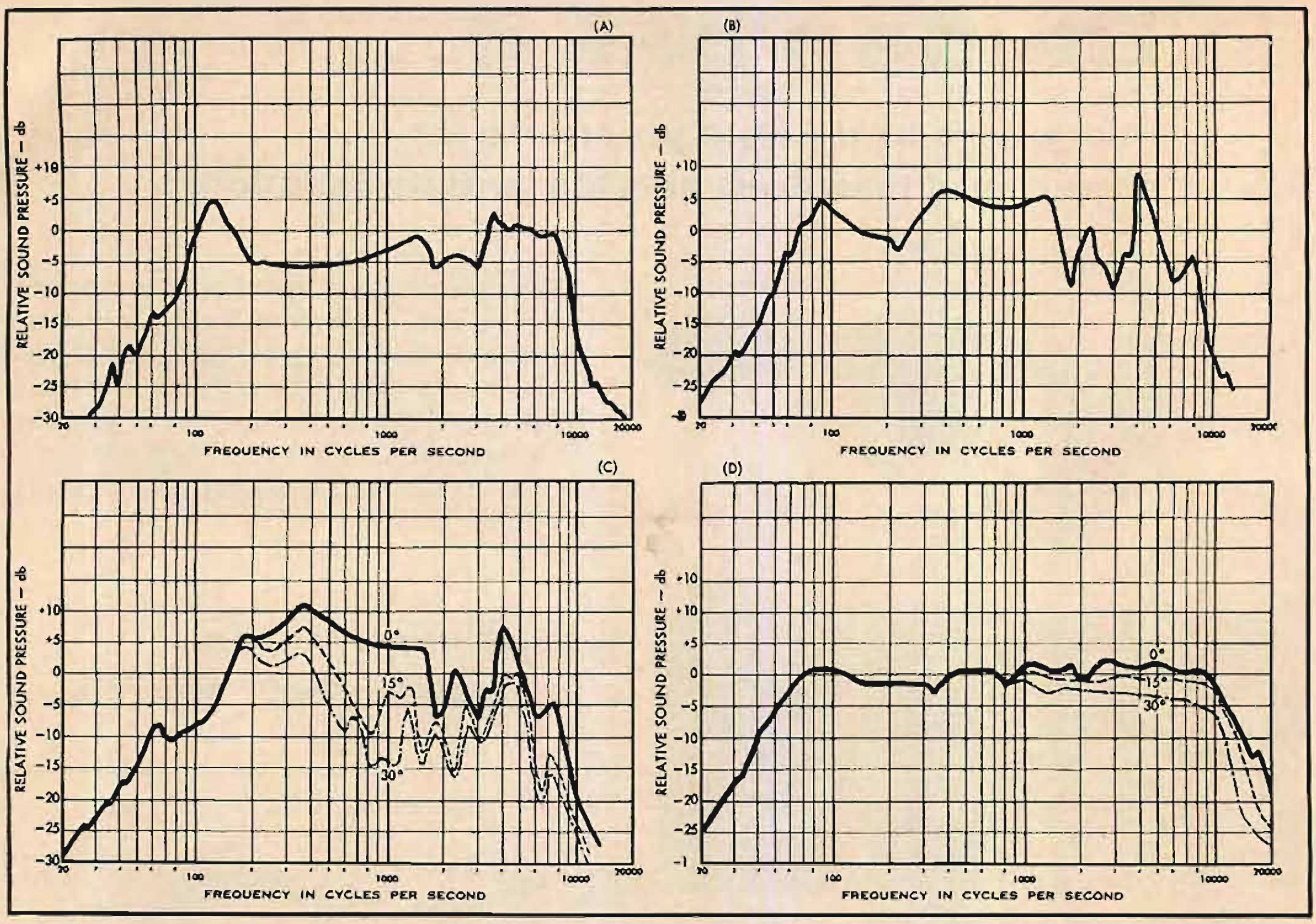

Fig. 4. Loudspeaker response curves: (A), single 6-in. unit in 8-cu.ft. box with closed back; (B), 32 6-in. units in same box with open back; (C), 32 6-in. units in same box with closed back; (D), 3-way bookshelf speaker system, Jensen TF-3, 1.5 cu. ft.

to any mutual coupling effects.

The array response above 1000 cps shows definite signs of destructive interference and requires no further comment.

The remaining response curve shows what performance can be expected from a carefully designed multi-channel loudspeaker system when each channel is designed to reproduce only a discrete portion of the frequency spectrum.

It was believed that the response data of the 32-speaker array illustrated poorly the performance that might be expected from an array because the fundamental resonance occurred rather high and the speakers were very lightly damped (high *Q*).

A second array was constructed with heavily damped ($Q < 0.5$) 8-inch woofers. The fundamental resonance of these speakers (in the cabinet) was 50 cps. The cabinet volume was allowed to increase in direct proportion to the number of speakers used in order to prevent the cabinet stiffness from increasing the resonance.

The frequency response of this system appears in *Fig.* 5. Because the center-to-center spacing was greater than that of the 32-speaker array, the frequency range of maximum gain occurred lower than before but the response trend is the same. A humping in output begins to occur in the range of maximum efficiency gain (100–200 cps.) The efficiency gain is negligible at 20 cps and begins to disappear above 1000 cps. This particular system when used in conjunction with a mid-range/tweeter combination crossed over between 400 and 600 cps should give excellent performance. But it is incapable of radiating 20 cps more efficiently than any of the individual speakers in the array. Actually, there is 5 db less 20 cps output relative to 400 cps for six speakers than there is for one alone.

Directivity Pattern

It was stated earlier that the directional pattern of a cone-type speaker depends primarily upon the cone diameter and the frequency. The equivalent speaker concept suggests that the directional patterns of an array should be much sharper since the physical size is greater. The situation is actually worse because the array is rectangular rather than circular and thus has one dimension considerably longer than the diameter of the equivalent speaker.

The directivity patterns of the 32-speaker array are shown in *Fig.* 6. These patterns are also approximately those of a single six-inch loudspeaker mounted in the center of the same cabinet. The important result is that the array has a frequency range of only 1/10 that of a single speaker for the same directional pattern around the longest dimension. The directional pattern around the short dimension will extend the frequency range to 1/5.

The data of *Fig.* 6 show that notches in the frequency response should appear 15 deg. off axis at 900 cps and about 1400 cps. Notches should also appear 30 deg. off axis at 450, 900, and 1400 cps. These are verified by the off-axis measurements in *Fig.* 4. By way of comparison, the directional pattern of the TF-3 bookshelf system drops off quite uniformly off axis.

The directional pattern of arrays can be widened by arranging the speakers on the arc of a circle as in *Fig.* 7. The directional pattern is now better than

(*Continued on page 37*)

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THE INSTITUTE OF HIGH FIDELITY MANUFACTURERS INC. PAGE

Hi Fi Show's A-comin'

THE WRITER recently came into rather close contact with the hi fi industry when the agency of which he is president was retained by the Institute of High Fidelity Manufacturers as Public Relations counsel for the upcoming New York High Fidelity Show, September 13 through 17, at the New York Trade Show Building, 35th Street and Eighth Avenue, in Manhattan.

Now that I've mentioned the show—and I assume everyone reading AUDIO will attend it—I would like to go on to another subject of interest, and that is the High Fidelity industry from the point of its public relations, and yes, its public "image." I address this piece to every one of you readers of AUDIO, whether your interest in hi fi is as a serious amateur or "audiofan" (as I have been taught to call you) or whether your interest in high fidelity is on a professional basis.

The industry you love is on the horns of the proverbial dilemma. It seems to be in something of a sales and "public interest" doldrum, yet it just possibly stands on the threshold of the most successful period in its history.

Which way to turn? What can you do, even as an interested bystander, to help the entire hi fi field?

I speak as a professional public relations man whose sole interest in hi fi ran, until recently, to owning some components and enjoying good music. But when I came to closer grips with the industry and its problems, several "truths" stared me in the face.

First, speaking as a general customer with a mere layman's knowledge of hi fi, it appears that for the past two or three years the equipment being manufactured has been of such general excellence that music reproduction has not been, nor could it be, substantially improved. Remember, I speak as the average hi fi Joe who installed stereo components when they first became generally available and has not since added to or altered his rig.

True, I am aware that many manufacturers have introduced new developments and new products, but to my untutored eye they appeared as "gimmicks" in which I just did not want to invest additional money. This assumes, of course, that I have a regular stereo hi fi rig with which I have been happy for a number of years.

I don't use the word "gimmicks" in a derogatory manner, for in my business too we often seek out gimmicks to better tell a client's story. But the addition of more knobs, higher sensitivity, greater selectivity, remote controls, reverb units—none of these things gave me the great urge to scrap my several hundred dollars' worth of equipment and start afresh. However, even the gimmicks reached their saturation point some time ago. Then came multiplex—now officially called FM Stereo Radio.

This is not a gimmick. This is a real and very exciting development in a very exciting industry. I have been talking to dozens of top editors and writers in the past weeks, and I know that there is a great interest, even a hunger, on the part of the public to know more about the whole subject of FM stereo radio. And this leads me to the further realization that there is a hunger on the part of a large segment of Americans for GOOD MUSIC that is WELL REPRODUCED.

The nationwide interest in FM stereo radio is an indication, at least to me, that there is a huge untapped market out there for high fidelity components. The hunger for good music well reproduced at a reasonable (but not "cheap") cost means that potential customers aplenty are there, and a means must be found to tap that vast market.

There are still too many people who think that high fidelity components represent an expensive and unnecessary gimmick they can do without. I therefore visualize a campaign by EVERYONE in the industry—and that includes you, the average hi-fi-oriented amateur—to promote (a), the growth of good music in the United States, and (b), the use of hi fi components as the only way to listen to this good music.

There is a true joy to hi fi listening just for pleasure's sake. There is a need to take the "bug" out of hi fi, to bring its pleasures to the attention of millions of people who would sincerely love to listen to good music through hi fi components IF the true *desire* or *need* is strongly built up in them to do so.

Thus, our goal is "Every Home a Hi Fi Home"—something that is in itself impossible of achievement but worthy of striving to reach.

I personally think that FM stereo, carefully and enthusiastically promoted, talked up, sold, made available, can be a major breakthrough. How can you, as an average hi fi fan, help promote the cause of good music in America? The answer is simple, but it is sound. Just talk it up at every opportunity. Each of you has a circle of friends—make a conscious effort to convert them to the cause of good music through hi fi components. Often merely a demonstration of the pleasure they can realize by listening to good equipment will do it. This campaign is not to be confined only to adults. You all have children or know some. Today, these children usually listen to rock and roll—the so-called "Top 40"—because usually they have no opportunity to hear anything else. Any intelligent child who is exposed in the proper manner to good music played on good equipment will sooner or later be a convert to our side.

I visualize a campaign undertaken unselfishly by every person, firm, and organization associated with the high fidelity industry, *together* with the FM broadcast industry, to encourage the establishment and continued success of GOOD MUSIC stations throughout the country, and not just in the top ten markets. There are millions of people in rural areas who would willingly listen to good music if only it were available to them.

We are seeking to create a new concept of "What Is Good Listening?" We must actively back the growth of high-quality programming on FM stations across the country. Too many FM stations are degrading their fine technical facilities with the material they are broadcasting, and I only hope that FM stereo doesn't suffer this same fate.

We all have an obligation to further the cause of good music. Our obligation extends to helping the children of today, and beyond them to helping the children of tomorrow. The quality of a nation's music may appear to be of small import in the over-all scheme of things relative to its rise or decline, but history indicates otherwise.

Again, the New York High Fidelity Show opens on September 13 for the trade only, and is open to the public from September 14 to 17 at the New York Trade Show Building. Start your crusade for good music by coming to the show—better still, make sure that your non-hi-fi-equipped friends come with you. They'll get so much more out of it with you along to explain things—and so will you!

—*Jay Weston*
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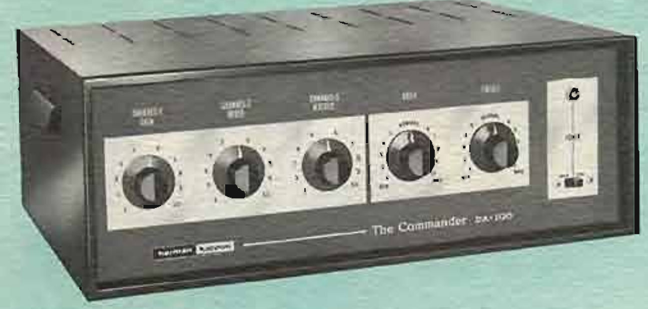
Designed to accommodate a wide variety of applications, this versatile moderate-power amplifier has a high gain channel for direct use with any crystal, ceramic, reluctance or dynamic high impedance microphone. Sufficient gain is available to operate any low impedance microphone, using any of the popular cable type matching transformers. Two "aux." channels are provided for connection to a crystal or ceramic phono, tuner or tape recorder output. These channels employ a single "fader" type gain control, so that two such program sources may be connected and controlled with a single knob, thereby achieving smooth, electronic change-over between the two programs. A master volume control is also included, enabling the total amplifier power output to be varied without disturbing other control settings. A 4-position filter adjusts the system for best music response, reduction of turntable rumble or record scratch, and protection of outdoor trumpet speakers against low frequency overload. An exclusive "anti-feedback" position equalizes frequencies most sensitive to the generation of feedback "howl" without reducing articulation, thus achieving maximum power output under difficult acoustical conditions. A separate output is available to drive a booster amplifier or tape recorder. Separate on-off switch permits the entire system to be turned off without changing any control settings. Plug-in speaker socket and aux. AC power receptacle are also included.

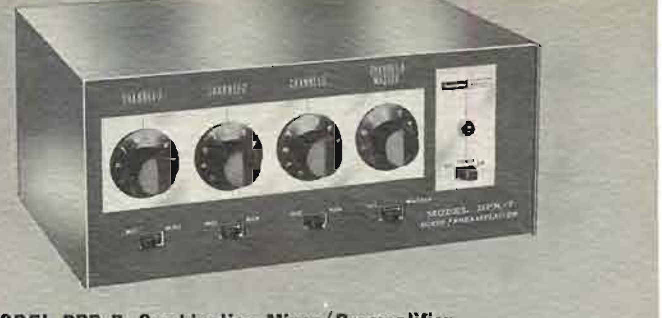
THE COMMANDER DA-35, 35 Watt PA Amplifier

If you're looking for an exceptional PA workhorse, the
Commander 35 watt amplifier is for you. This remarkable uni
corporates design features not found on any other amplifier.
unique input and control arrangements permit an unusual degr
installation and operational flexibility. There are four channels:
low level, high gain and two high level. Multiple inputs resu
further versatility. Channel 1 offers a choice of either a microp
or switched input for magnetic phono cartridge. A choice of tw
puts is also provided for Channel 2; one for a microphone anc
other for use with any high level, high impedance program sc
regardless of sensitivity requirement. Channel 3 is also for high
auxiliary equipment, such as tuners, tape recorders, telephone
crystal or ceramic phono players. A fourth ("mixer") channel is i
porated which, when used, will feed any high level, high imped
program into Channel 2 through a tandem control so that both si
can be completely faded *or blended* in any desired amount—using
the Channel 2 control knob for especially convenient one-hand co
Ideal for square dances, demonstrations, lectures, etc. When not o
wise used, Channel 3 is *convertible* to a Master Volume Contro
the entire system—thus preserving program balance and gain se
when adjusting total amplifier output. The DA-35 also includes
rate bass and treble boost/cut tone controls; two plug-in speaker
ets in addition to the usual output terminal strip; separate O
Power Switch; aux. AC power receptacle. Output to a tape recor
provided, independent of tone and master volume controls. Fil
DC on the filaments of high gain stages keeps hum to a negli
level. This is an amplifier you need never hesitate to use with the
quality speakers, and it is rock stable, regardless of load conditio



HE COMMANDER DA-100, 100 Watt PA Amplifier

Here is truly the powerhouse of PA amplifiers—the new DA-100. 0 watts of distortion-free power at a price you'd expect to pay for watts! A magnificent continuous duty amplifier, the DA-100 in-orporates all of the unique facilities and operational advantages of e DA-35. DC on all low level stages virtually eliminates hum. Use f hermetically-sealed 800 P.I.V. silicon power rectifiers insures low eat and a highly regulated, efficient power supply. The extra reserve ower of the DA-100 insures cool-running, trouble-free performance nder any load condition. It permits future expansion of a system ithout need to resort to additional booster amplifiers. The DA-100 presents exceptional value. Compare its specifications with units hich compete in price—yet have a much lower output and few of its atures. You'll discover the unique value, the handsome design, the exibility, versatility and dependability of the DA-100 deserve your onsideration, when you're looking for reliable, trouble-free power.



THE MODEL DPR-7, Combination Mixer/Preamplifier

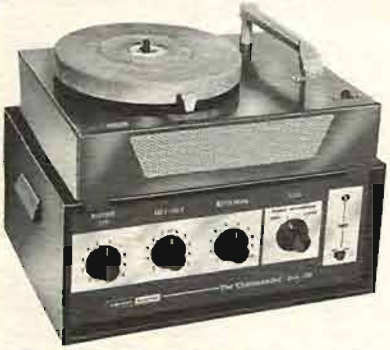
An unusual *combination* unit professionally designed for use with any sound system. No matter how high the quality requirement, the DPR-7 fulfills the need for additional channels and is a practical way to expand a sound or recording installation. It is unlike any other popular-priced mixer in many respects: The self-contained power supply applies DC on all tube filaments. Frequency response and sensitivity are exceptional; hum and noise virtually non-existent. Seven inputs are provided, five low level, high gain and two high level. Channel 1 offers a choice of microphone or magnetic cartridge input; Channels 2 and 3 *each* provide a choice of microphone or input from tuner or tape recorder and crystal or ceramic phono player. All are switchable from the front panel, thereby making it possible to use these inputs at will without having to rearrange input connections. Channel 4 is another microphone channel which, however, is convertible to a master volume control for the entire mixer by a front panel switch. The DPR-7 is thus not only a highly versatile mixer but a superb, completely self-contained preamplifier which can *remotely* control multiple program sources. Adjustable re-set indicators are provided for all controls; no need to log or remember previous settings. Low impedance cathode-follower output permits long line runs to the main amplifier or to simply a basic power amplifier, and delivers sufficient voltage to drive several amplifiers simultaneously. Output to a tape recorder is also available, and an aux. AC power receptacle is included. The DPR-7 is self-supporting or may be front-mounted into a wall, cabinet, etc.

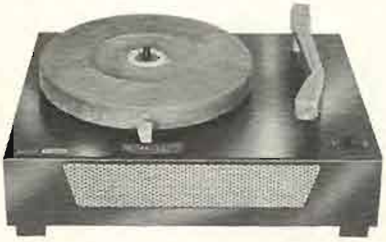
A continuing vital tool for commerce and industry with which to chieve greater efficiency and economy of operation—*sound* has more cently been experiencing an increasingly rapid growth in application, well as demands for better quality and operational capability. Un-oubtedly, some of this has been stimulated by the general public's ex-osure to high fidelity.

Quality, dependability and the highest standards of performance are aditional with Harman-Kardon. This is evidenced by the hundreds of ousands of H-K and Citation amplifiers, preamplifiers, tuners and ceivers in daily use throughout the world and by the many commen-tions accorded this equipment in independent and objective test reports.

As the largest manufacturer of such equipment, H-K brings to the commercial sound business the full resources of a progressive company, with an engineering staff steeped in many years of intimate experience in the field of commercial and industrial sound. Result: The Commander Series.

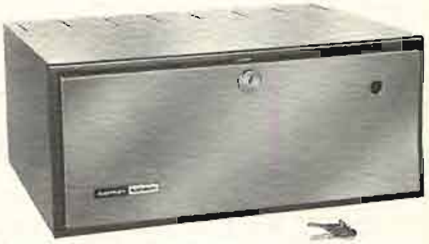
The Commander Series is indeed an achievement born of a refreshingly new approach to practical application requirements and painstaking attention to self-imposed, stringent technical standards. That the Commander Series should in fact be "deluxe" equipment at popular prices reflects the modern, highly efficient production techniques long established at Harman-Kardon. The Commander Series will do *more*, do it *better* and for *longer*.





E COMMANDER PT-1, Phonograph Top

This excellent unit, designed for rugged duty, mounts directly to the top of models DA-12, A-35, DA-100 (as shown at left) or it may be used free-standing on hide-away levelers. A avy-duty motor provides all four recording speeds; idler has disengage position when player not in use, to prevent "flat spots." The turntable is made of heavy gauge metal, flocked to otect record surfaces, and has a built-in center hole adapter for 45 RPM 7" records. Hum duction is prevented by the shielding effect of the ferrous metal turntable and the location the tonearm. Quality turnover-type cartridge is included, for use with all size and speed cords; standard replacement stylii are employed. A separate power switch is used to turn the ayer on and off. For use with 105-125v, 60 cycle AC. Dimensions: 4¾"H, 11½"W, 10¼"D. ipping weight: 8 lbs. The Commander PT-1—$37.50 List



MODELS LC-1 AND LC-2
Locking Panel Covers

The Commander's special locking covers prevent tampering or accidental change to the precise control settings of your equipment. The amplifier pilot light is visible at all times through the aperture in the cover. The LC-1 fits models DA-12 and DA-35; the LC-2 fits the DA-100. No tools are needed for installation; the covers take only seconds to insert or remove from cage. Two keys provided. Shipping weight: LC-1—2¼ lbs.; LC-2—2½ lbs. Model LC-1—$8.50; Model LC-2—$9.00 List

TECHNICAL SPECIFICATIONS

THE COMMANDER DA-12

12 Watt PA Amplifier

Rated Power: 12 watts
Frequency Response: 30-20,000 CPS ±2 db
Inputs: 1 Mic., 2 Aux.
HUM AND NOISE
(Fundamental): —75 db below rated output
@ Mic. input: —55 db below rated output
@ Aux. input: —75 db below rated output
GAIN
Mic. Input: 117 db
Aux. input: 84 db
SENSITIVITY
Mic. input: 5 millivolts
Aux. input: 0.35 volt
Outputs: 4/8/16 ohms (plus speaker plug-in socket), and output for booster amplifier/tape recorder.
Controls: Channel 1 Gain, Aux. 1 and Aux. 2 Gain (fader), Master Volume, Filter: normal/rumble/anti-feedback/scratch, power on-off, pilot light aux. A.C. outlet.
Tubes: 12AX7, 6L6GC, 5Y3GT
Dimensions: 14"W, 6"H, 10¾"D
Shipping Weight: 18 lbs.
List Price: $75.00

THE COMMANDER DA-35

35 Watt PA Amplifier

Rated Power: 35 watts
Frequency Response: 20-20,000 CPS ±2 db
Inputs: 2 Mic., 3 Aux.,1 Mag. phono
Outputs: 4/8/16/150 ohms; 25v balanced, 70v unbalanced, tape recorder, 2 speaker sockets.
Controls: Channel 1 gain, Channel 2 gain, Mixer-Fader (tandem with Channel 2), Channel 3 gain (optional Master Volume), Bass, Treble, Mag. phono switch, optional master volume switch, power on-off switch, pilot light, switched aux. A.C. power outlet.
HUM AND NOISE
(Fundamental): —80 db below rated output
Mics. and Aux.: —55 db below rated output
Channel 3 and Mixer: —75 db below rated output
GAIN
Mic. inputs: 124 db
Aux. input: 95 db
Channel 3 and Mixer Inputs: 89 db
SENSITIVITY
Mic. inputs: 4 millivolts
Aux. input: 0.175 volt
Channel 3 and Mixer Inputs: 0.35 volt
Mag. phono input: 10 millivolts
Tubes: 12AX7, 6AV6, 7247, 2-6L5GC, 5U4GB
Dimensions: 14"W, 6"H, 10¾"D
Shipping Weight: 23 lbs.
List Price: $119.95

THE COMMANDER DA-100

100 Watt PA Amplifier

Rated Power: 100 watts
Frequency Response: 20-20,000 CPS ± 2 db
Inputs: 2 Mic., 3 Aux., 1 Mag. phono
Outputs: 4/8/16/50 ohms; 25v balanced, 70v unbalanced, tape recorder, 2 speaker sockets.
Controls: Channel 1 gain, Channel 2 gain, Mixer-Fader (tandem with Channel 2), Channel 3 gain (optional Master Volume), Bass, Treble, Mag. phono switch, optional master volume switch, power on-off switch, pilot light, switched aux. A.C. power outlet.
HUM AND NOISE
(Fundamental): —85 db below rated output
Mics. and Aux.: —60 db below rated output
Channel 3 and Mixer: —80 db below rated output
GAIN
Mic. inputs: 128 db
Aux. input: 100 db
Channel 3 and Mixer inputs: 94 db
SENSITIVITY
Mic. inputs: 4 millivolts
Aux. input: 0.175 volt
Channel 3 and Mixer: 0.35 volt
Mag. phono input: 10 millivolts
Tubes: 12AX7, 12AV6, 7247, 4-6L6GC plus full-wave doubler, using hermetically sealed 800 P.I.V. silicon power rectifiers.
Shipping Weight: 36 lbs.
List Price: $187.50

THE MODEL DPR-7

Combination Mixer/Preamplifier

Inputs: 4 Mic., 2 Aux., 1 Mag. phono
Frequency Response: 15-30,000 CPS + zero db, —0.5 db
Rated Output: Zero DBM, at less than 0.1% T.H. Distortion. 13.5 volts, at 1% T.H. Distortion
GAIN
@ Mic. inputs: 66 db
@ Aux. inputs: 34 db
@ Mag. input: 43 db
SENSITIVITY
@ Mic. inputs: 1 millivolt
@ Aux. inputs: 75 millivolts
@ Mag. input: 10 millivolts
HUM AND NOISE (@ 13.5v output)
Fundamental: —95 db
Mic. @ Max.: —85 db
Aux. @ Max.: —90 db
Output: Low Impedance cathode-follower, min. recommended load imp.: 10,000 ohms
Controls: Gain controls for Channels 1, 2, 3, 4; Mic.-Mag. switch for Channel 1, Mix-Aux. switches for Channels 2 and 3, Mic.-Master switch for Channel 4; power on-off, pilot light, switched aux. A.C. power outlet.
Tubes: 2-12AX7, 12AU7, plus silicon rectifier power supply for filaments and high voltage
Dimensions: 5⅛"H, 11½"W, 5½"D
Shipping Weight: 10 lbs.
List Price: $75.00

Prices and specifications subject to change without notice. Prices slightly higher in the West.

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(*from page 30*)

that of a single speaker. Time did not permit the construction of such a cabinet so that the effects upon mutual coupling are not known. It is doubtful, however, that there will be much of a change.

Transient Distortion

The response curves of *Fig.* 4 imply that the transient distortion at frequencies above 1000 cps will be greater for the array than for a single speaker. A consideration of the large amount of acoustic loading (resistive) suggests that the transient distortion between fundamental resonance and 1000 cps should be less for the array.

Data verifying this are shown in *Fig* 8. These measurements were made in an anechoic chamber. The speakers were energized with tone bursts. The criterion used for judging the degree of distortion was the sound pressure difference between the remaining transient and the steady state signal at a time interval of 5 milli-seconds after the tone burst was cut off. The results substantiate the conclusions reached by Larson and Adducci; a smooth response is usually accompanied by low transient distortion.

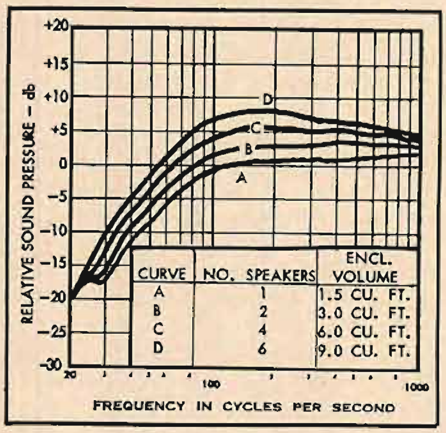

Fig. 5. Curves showing sound pressure level for one or more loudspeakers.

Harmonic Distortion

As is to be expected, the total harmonic distortion of an array is considerably less than the distortion produced by a single speaker. The reasons for this reduction were discussed earlier. *Figure* 9 shows several distortion measurements.

The humps in the distortion curves (B) and (C) occur at the fundamental resonances of the speakers. The excursion or amplitude of the moving system maximizes at resonance because the speaker damping is quite small. Because the moving system is stiffness-controlled below resonance, the distortion eventually again increases because of the non-linear suspension.

The most interesting characteristic is that of curve (A). The speakers were the same as those of curve (B) with the exception that the back of the cabinet was enclosed. The reason for the drastic reduction in distortion is apparent when one considers that now 75 per cent of the total stiffness is due to the cabinet volume. This type of stiffness is much more linear than that of the cone suspension which is the only stiffness present in (B) and (C).

It is possible to obtain distortion characteristics from a single speaker as good as those of (A) in *Fig.* 9. This is illustrated in (A) of *Fig.* 10. The total harmonic distortion of the TF-3 is less than 1 per cent above 50 cps and is half of the array distortion at 20 cps. Because the mid-band efficiency of the array is 6 db greater than the TF-3 efficiency, a second measurement was made on the TF-3 with four times the power input (20 watts). The distortion characteristic, (B), is about the same as that of the array. It should be remembered that this distortion characteristic is now being obtained from a speaker system having a greater band width, smoother response, less transient distortion, broader directivity patterns, smaller size, and lower price tag.

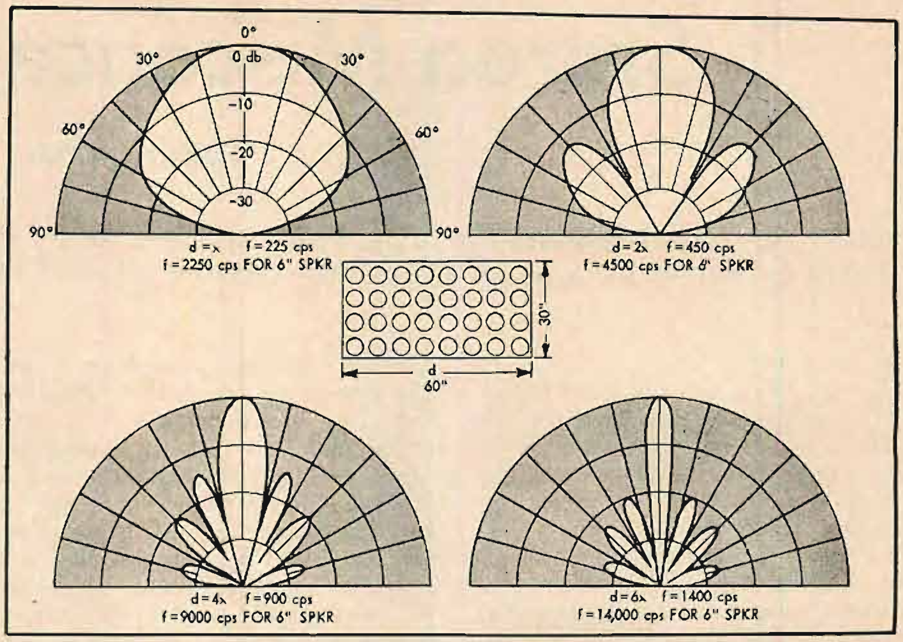

Fig. 6. Directivity patterns for array of 32 6-in. speakers.

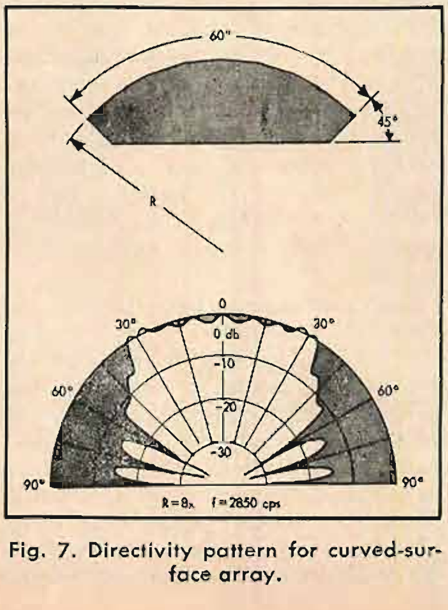

Fig. 7. Directivity pattern for curved-surface array.

FM and IM Distortion

No quantitative measurements of FM and IM distortion were made on any

(*Continued on page 91*)

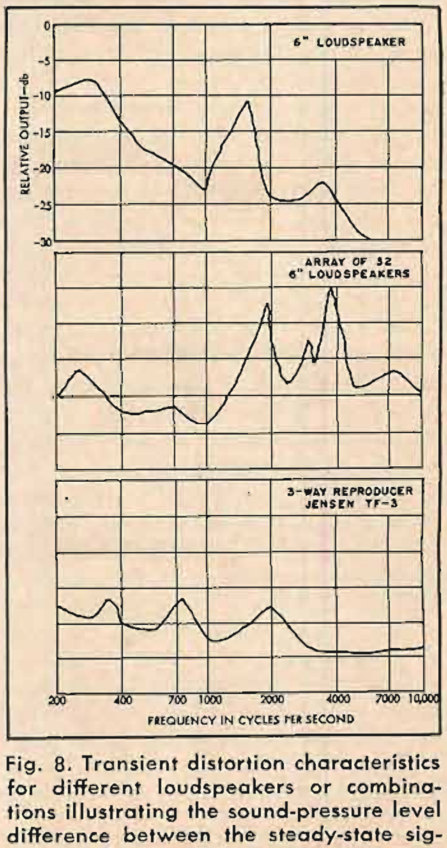

Fig. 8. Transient distortion characteristics for different loudspeakers or combinations illustrating the sound-pressure level difference between the steady-state signal and the remaining transient 5 milli-seconds after the tone burst is cut off.

Stereo Misconceptions

JAMES C. CUNNINGHAM*

"Move the concert hall into the living room" has been the cry of many stereo "experts." In contradiction to that thesis, a recording engineer asks that we move the living room into the concert hall.

STEREOPHONIC SOUND is the simultaneous occurrence of many phenomena. To study only one phenomenon without an awareness of its inseparableness from all other phenomena is erroneous and leads to fundamental misconceptions of stereo.

Perhaps if some of the popular misconceptions of stereo are reviewed, the interdependence of these phenomena will emerge. Perhaps also some controversy will arise—at least it is hoped for—hence the adoption of a theme of heresy for this article.

In 1933 the Bell Telephone Labs performed their famous experiments with stereo. In the almost 30 years since these experiments, nothing on such a dazzling scale has been attempted—so for many the data arrived at then is still the final word on stereo. In the light of present day knowledge this data holds up well. For present day *usage,* however, this data is of little value, because now the listener we are concerned with is in the living room rather than the auditorium which was the location of the Bell Lab studies. The techniques for recording and reproducing stereo in these two locations is so vastly different that they should probably be given different names. This fundamental difference is the basis for many of the misconceptions we are concerned with and is thus worthy of some investigation.

Auditorium stereo is merely a matter of simulating the directionality of the instruments of the orchestra along with their quality—the acoustics already exist so none should be introduced in the recording system. The ideal system would have *n* number of channels equal to the number of instruments in the orchestra—*n* number of microphones with ideal directional characteristics to pick up only one instrument, *n* number of perfect amplifiers, a perfect recorder, and *n* number of loudspeakers—each with radiation characteristics identical to the instrument it reproduced and placed in the appropriate place on stage. The recording should be made in an anechoic chamber with musicians especially trained for the ordeal of having to stay on pitch in these surroundings. The Bell Labs study was concerned with the problem of approaching this ideal with only three channels.

The difference between auditorium stereo and living room stereo is obvious if we imagine crowding our *n* number of loudspeakers in the living room and playing back what was the ideal tape for the auditorium. It would, of course, sound absurd without the auditorium acoustics. Stereo is too often described as "like having the orchestra in your own room". Actually we want the reverse—the living room should be in the auditorium and somehow have its walls and ceiling made acoustically transparent. Such an ideal is impossible to achieve because a wall of reproducers necessary to produce a plane wave would reflect the sound from the opposite wall of reproducers and thus be transparent in only one direction. Any hope of reproducing, in the living room, the exact environment of a concert hall is patently quixotic because the room has characteristics of its own which must unavoidably be a part of the reproduction.

That two channel stereo is able to achieve the illusion of a "living room in a concert hall" to the extent that it does, is remarkable. The credit for this achievement goes largely to the recording engineers who, in spite of a lagging theory, have constantly improved the art. This is not to say that all stereo recorded today is good stereo—unfortunately some of it is not even stereo, but two channels of monophonic sound. This grave misconception is often excused as "commercial sound" to exploit the novelty of stereo. Actually it is probably either indolence or ignorance on the part of the engineer and/or producer. Separation is the battle cry for this kind of stereo, and the more the better.

The reason why separation is the enemy of good stereo is not generally understood if one is to judge by the technical literature of the past few years. If we return for a moment to the idea of the living room in the concert hall as the ultimate goal of reproduction certain facts emerge which are useful. First, the listener is aware that the various sound sources emanate from many different points on stage; second, although he is unaware of it, the direct sound from each source arrives at his two ears first, followed by multiple reflections of this same sound from the walls and ceiling. The important fact here is that the direct and each reflected sound arrive at his ears from *different directions* enabling his binaural hearing mechanism to analyze the sound in the normal fashion. Both of these conditions can be approximated in well-recorded and reproduced stereo. It is obvious that they cannot in mono because with only one channel all directionality is lost. It is not so obvious why two channel mono—the type with almost complete separation—does not fulfill these conditions either. True, there is direction—but only two point sources—the two loudspeakers, not a spread of images between the speakers. There is no possibility of the second condition being fulfilled, hence no real spatial effect, no matter how much the echo chamber is used.

To illustrate the truth of these statements, some diagrams will be helpful. *Figure* 1 shows the well known Haas effect or the relationship between time and intensity existing when two loudspeakers reproduce the same sound but with both time and intensity varied according to the curve to keep the sound image midway between the speakers. There is more, however, to this curve than meets the eye. It does not mean, as some have said, that we can trade intensity differences for time differences in stereo and therefore explain stereo in terms of intensity alone. This brings to mind another canard called "Intensity Stereo" which will be treated later, but for the moment let us look again at *Fig.* 1. As the sound emanating from loudspeaker B is delayed with respect to loudspeaker A, the listener at C hears the sound image D move gradually toward speaker A. This occurs during the first three milliseconds and might be called the primary effect of the Haas effect. After three milliseconds the image stays at A but as the delay is increased, the sound begins to take on "body" or "fullness." This is the secondary effect. When the delay reaches 50 milliseconds the listener hears two distinct sounds or an echo. But why the "fullness"?—Because we are by syn-

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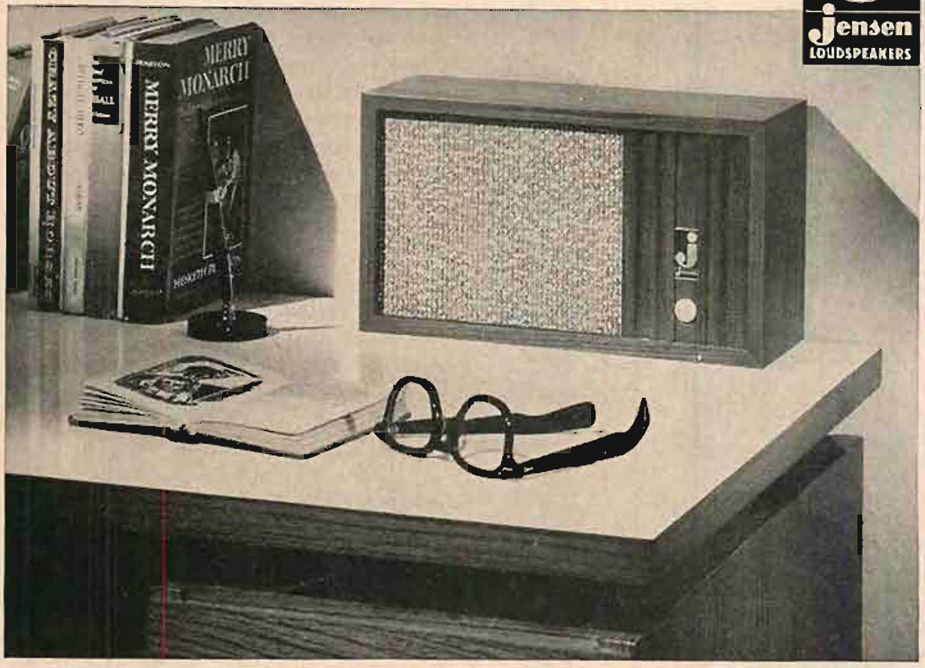
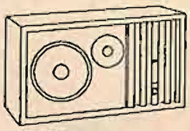
* *Universal Recording Corp., 46 E. Walton St., Chicago, Ill.*

So Compact... Jensen Loudspeakers X-10



A startling achievement—an ultra-compact (7¼″ H, 13″ W, 4⅝″ D) 2-speaker system capable of sound you'd expect from a much larger unit. Volume control on front. Perfect for FM Multiplex, very low cost stereo, other-room extensions.

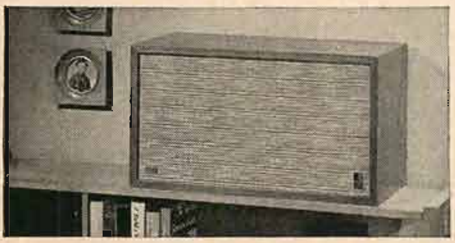


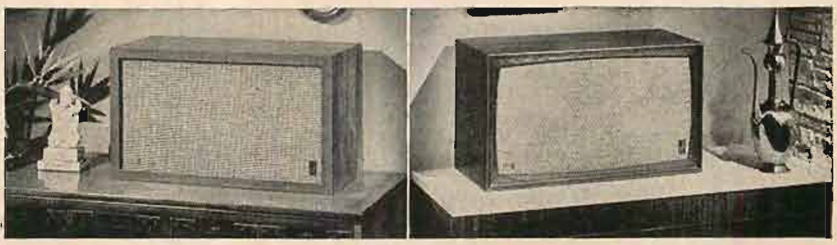
X-10 2-speaker 2-way system for use with amplifier having 4, 8, or 16 ohm output. Power rating 6 watts. Adequate room sound with 1 watt to speaker.

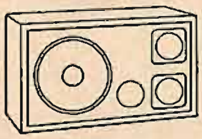
In Oiled Walnut..............$29.75

So Big in Sound... Jensen Loudspeakers TF-2 .... TF-3

Strikingly beautiful compact bookshelf systems—perfect for every stereo or mono hi-fi need. Recent "blindfold" tests by audio experts proved a preference for the TF-3 *and* TF-2 over "rated" systems costing much more. Make your own careful comparison. You will be delighted with such big sound in small space.

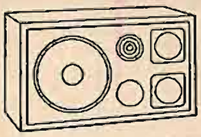






TF-2 3-speaker 2-way system. Full size Flexair* woofer for distortion-free bass response, plus two special direct radiator tweeters giving extended smooth highs. 13½″ H, 23¾″ W, 11⅜″ D.

In Oiled Walnut........................$79.50
Unfinished Hardwood..................$64.50



TF-3 4-speaker 3-way system. Covers full frequency range with Flexair* woofer in Bass-Superflex* enclosure, two coloration-free midrange units, and the sensational Sono-Dome* Ultra-Tweeter. 13½″ H, 23¾″ W, 11⅜″ D.

In Oiled Walnut..$99.50
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*T.M. Reg.

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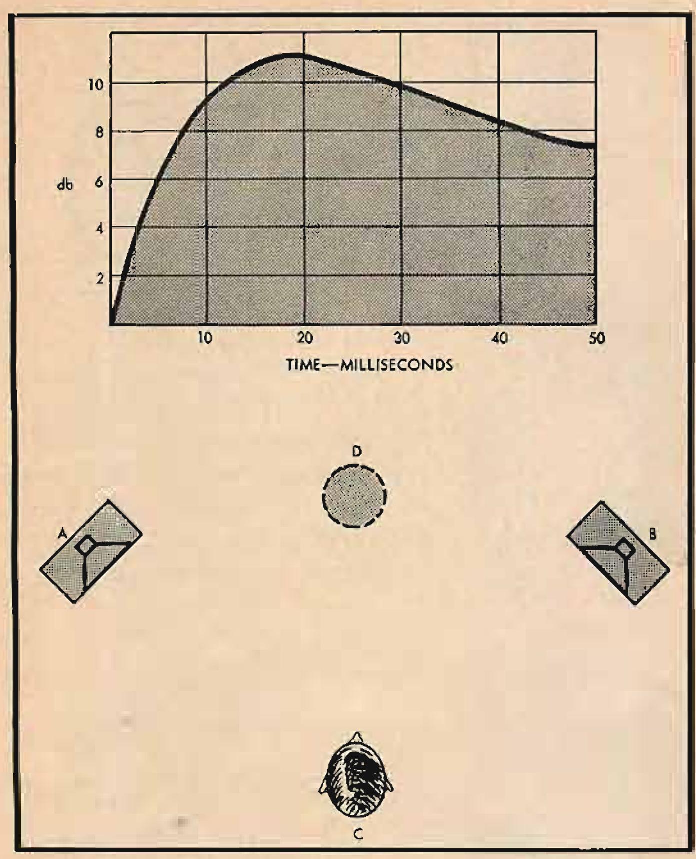

Fig. 1. Relationship between time and intensity when two loudspeakers reproduce the same sound (Haas effect).

thetic means giving the listener a taste of what he gets in the concert hall—i. e., a direct sound followed by a reflection of this sound from *another direction* and with the longer delay time associated with the concert hall. Of course, this is not stereo, but this condition can occur in a stereo system if wide microphone spacing is used such as is shown in *Fig* 2. This is a kind of super-real condition because the reflected sound is normally modified in quality by the process of reflection. The more real condition also occurs in stereo as shown in *Fig.* 3 and is the tertiary element of the Haas effect. Here the time difference of two direct waves (solid lines) is small and only influences the directionality of the reproduced sound. Thus the direct sound is shown emerging from the left and the reflected sound (dotted lines) from the right. Under ideal conditions both the direct and reflected sounds will have virtual images effectively "filling in" the space between the loudspeakers. This is still far from the ideal of making the walls and ceiling sound transparent but is a great improvement over monaural or two-channel mono sound.

Two-channel mono sound usually results in a studio recording session when each instrument is close-miked in the normal monaural fashion then the channel switches are thrown to put half the instruments on one channel and half on the other, and adding the proper amount of reverberation via the echo chamber. This is equivalent to grouping half the instruments around one microphone and half around the other and putting a wall between them as shown in *Fig.* 4. The Haas effect cannot operate here, in fact no reflections to speak of exist in either channel and this is why reverberation must be introduced.

While more latitude is possible with this type of recording since it is usually popular music and is not associated with a set acoustical environment as serious music is, the excuse of the engineer that he has no time during a recording session to achieve a good stereo effect is a false one; false because it is false economy to turn out mundane recordings. Actually many of the best selling stereo records have been a compromise between the extremes of good and bad stereo. One example that comes to mind uses the percussion instruments in a superb stereo pickup—a wise choice since the stereo effect is transmitted largely by the transients—and the melodic instruments are close-miked on the two channels. The result is somewhat strange because the percussion pickup wafts the listener into the studio then he is suddenly jolted back into his own living room again when the close-miked melodic instruments enter. Many such acoustic distortions are possible in the realm of two-channel stereo and the enterprising producer in search of a gimmick to sell records might do well to find them.

One thing that makes the job of the producer and engineer difficult is the great variety of stereo systems existing in this country. A stereo system consists of the apparatus and the listening room together. No worthwhile research has been done on this kind of system because no two systems in the world are alike. It is safe to say, however, that the listening room nearly always has a detrimental effect on the apparatus used as far as the stereo effect goes. One only has to move the apparatus outdoors for proof of this statement. There the stereo illusion is not reduced by standing waves, wall reflections, etc., so spatiality and direction are very precise. It is interesting to note that this quality of stereo can be had indoors by increasing the number of stereo channels to at least four. There are, however, a number of other possible

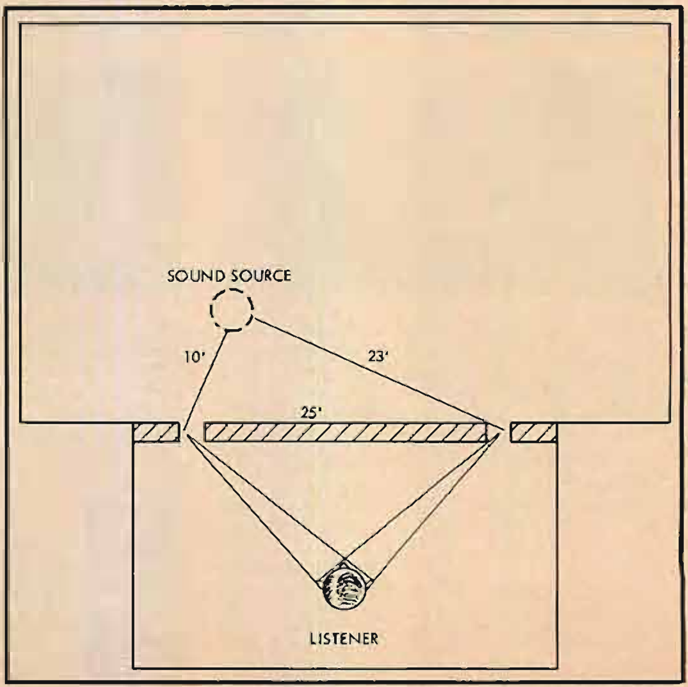

Fig. 2. Wide microphone placement.

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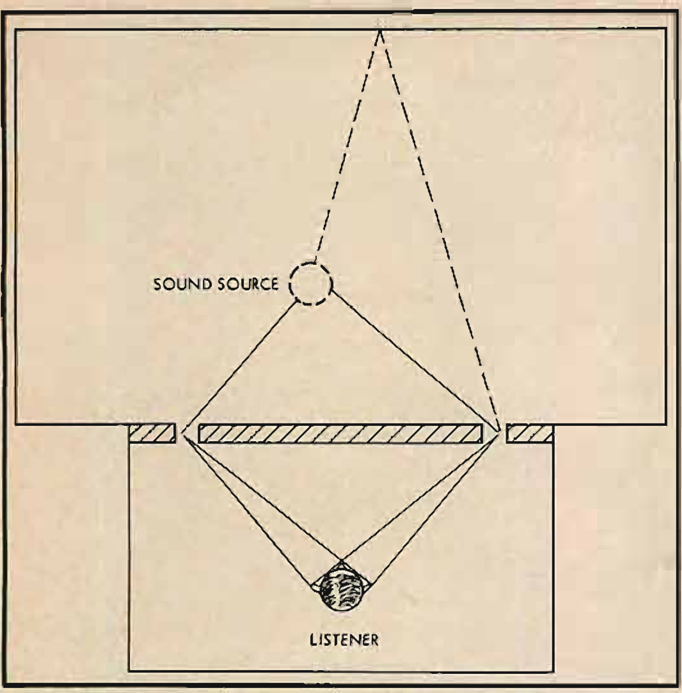

Fig. 3. Better microphone placement.

solutions to this problem of listening room acoustics and it is hoped that the future will bring research in this field. The recent addition of spring reverberators to many commercial stereo systems is certainly a step in the wrong direction if the reverberation is simply added to both channels. One manufacturer, at least, has had the good sense to put this delayed reverberation on a third channel so the speaker can be placed, say in the rear of the room to stimulate the sound from the rear of the concert hall. This principle has been called ambiophonic sound by Philips of Holland. They use a tape delay system to enlarge electro-acoustically the size of a small auditorium. This system works on the principle of submerging the unwanted effects of small room acoustics rather than removing them. Perhaps this has merit, if an economical version can be worked out, in approaching the ideal of a living room in a concert hall.

It was shown earlier that the Haas effect involves three elements to create the stereo illusion and it is related to and inseparable from intensity. Often it is stated that a time difference is merely a phase difference at a certain frequency, so that stereo is phase and intensity differences. A further reduction to absurdity is the so called "Intensity Stereo" which would imply that stereo is nothing but intensity differences. If this were true we would be able to play a mono recording of a piano over two loudspeakers, lower the level of one speaker and have a stereo recording. This does not mean that "Intensity Stereo" is an invalid method of recording—but it does mean the explanation (and the name) given it is an oversimplification which leads to a total misconception of stereo.

"Intensity Stereo" uses 2 directional microphones placed as close together as possible with a matrix network on their outputs which enhances the intensity differences in the two channels. Thus the Haas effect will not operate in the manner shown in *Fig.* 2. Hence the listener will have to depend entirely on intensity differences between channels to get directional perceptions. The tertiary effect of the Haas effect will, however, operate with this system thus providing different paths for the direct and reflected sound and giving the spatial effect of stereo. If any evaluation is to be made as to the relative merits of "Intensity Stereo" as against the spaced microphone system, such an investigation must take into account the fact that music itself is variable with regard to the stereophonic effect. For example, music with rich transients would fare best with a spaced-microphone technique because of the primary and secondary elements of the Haas effect. On the other hand sustained music with few percussive effects would probably do better with an "Intensity Stereo" technique.

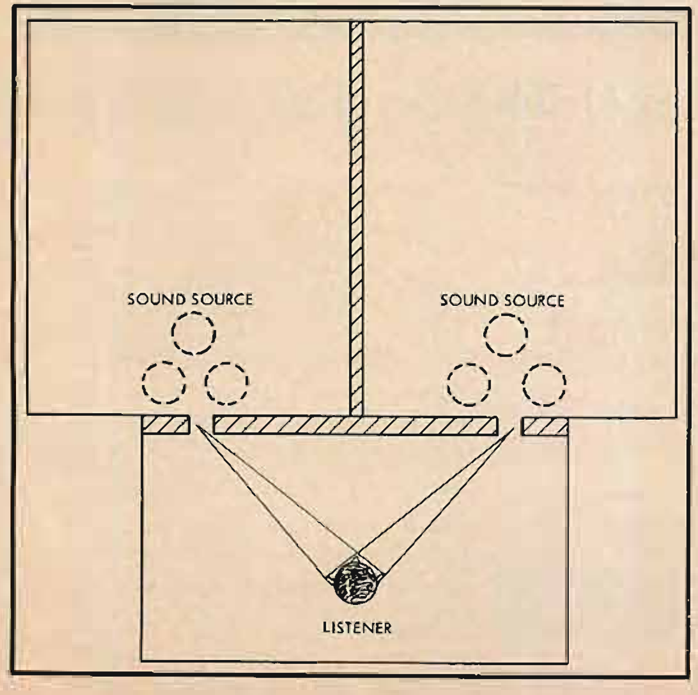

Fig. 4. Two-channel mono.

The Future Prospects

If two-channel stereo recording and reproduction is to progress, an awareness by all who are responsible for this art is necessary; an awareness of the entire process on both sides of the loudspeakers . . . of exactly what clues *from* these two loudspeakers are used by the brain to form an impression of an orchestra in its own acoustic setting. An understanding of binaural hearing is not enough—it is necessary to know what clues to present, via the two loudspeakers, to give the binaural hearing mechanism the impression that it is *in* the acoustic setting. On the other side of the loudspeakers, any number of microphones, in any setup, and using any tricks at hand are permissable *if* they help to form such an impression.

This article has tried to point out some of the pitfalls in this process and encourage further experiment in what is still a young and challenging art. Æ

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Loudspeaker Magnet Design

NORMAN H. CROWHURST*

Alignment of the individual crystals in a magnet used for a loudspeaker can result in a considerable improvement in performance for a given weight of the magnetic material.

THERE ARE THREE IMPORTANT AREAS in loudspeaker design: (1) design and fabrication of the cone, or radiating element; (2) suiting an enclosure to the characteristics of the unit; and (3) design of the transducer element, the part that converts electrical energy, as voltage and current, into mechanical energy to drive the cone, as force and movement.

Because the magnet has been one of the more expensive elements in the manufacture of loudspeaker units, there has been a trend, where competitive price is a factor, to cut down on the magnet. Unfortunately, in the way this is done, the effect is insidious.

Familiar Story?

The manufacturer is using, say, a 2-pound magnet, which represents maybe 60 per cent of his total material cost. Cutting the size to 1½ pounds would substantially reduce cost. He has a loudspeaker made up with the smaller magnet and makes an A–B comparison with a stock 2-pound magnet unit. The difference is there, but not dramatic. So he goes into production on the one with the 1½-pound magnet.

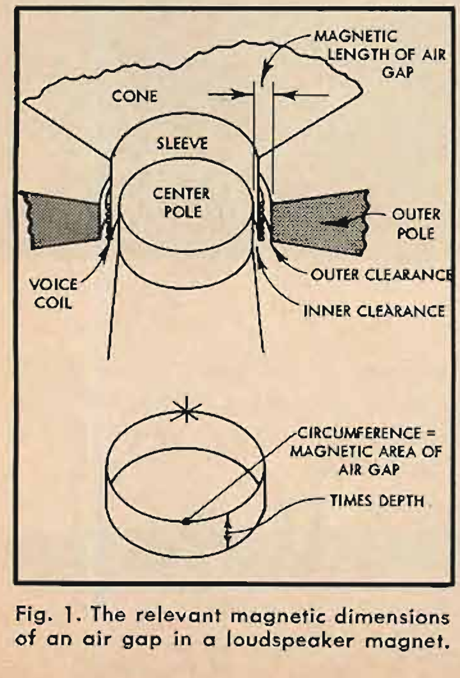

Fig. 1. The relevant magnetic dimensions of an air gap in a loudspeaker magnet.

A year or so later, again reviewing his price structure, he finds the magnet is still the biggest single item of material cost, by far. Reducing from 2 pounds to 1½ pounds, effected some saving, so let's try going a little further: a 1-pound magnet. This change also produces an audible, but not dramatic difference.

This process, over the years, results in the manufacture of units with magnets weighing only ounces. If the last were compared with the first, the midget magnets would never have been accepted. But deterioration by small degrees has downgraded the product.

A manufacturer with higher standards will not allow his product to be downgraded in this way. He decides on a minimum acceptable flux in the gap. After trying many samples, he gets one sample of a magnet made with Alnico V that meets requirements, and places a large order. Only later, when some units do not measure up to the performance of his reference unit, does he find that his stock Alnico V magnets do not consistently measure up to the results obtained with the sample.

Transducer Design

In the over-all transducer design, the objective is to provide the maximum efficiency of transfer from electrical to mechanical energy for the cost allocated. The variables are: shape and size of the coil, shape and size of the gap in which it moves, and the magnet which energizes that gap.

For an extended range or tweeter unit, the coil should be as light as possible consistent with electrical efficiency. For woofers the coil may be heavier, because the cone and other moving parts are usually heavier. This means the size, and probably the shape of the gap will vary according to application, even with units employing the same cone or frame size.

Depending on the power handling capacity, the clearance between coil and pole faces may vary. Also affecting this is the degree of precision used in the assembly operation. A smaller clearance enables efficiency to be pushed up, because greater magnetic field can be obtained from the same volume of magnet.

Magnet Design

Basically, the dimensions of the magnet should bear a specific relationship to the dimensions of the gap. For magnetic purposes, the length of the gap is the distance measured between the concentric pole-faces, (*Fig.* 1), while cross-section is the circumference of the gap multiplied by its depth.

Neglecting leakage, a gap with twice the spacing between poles will require a piece of magnetic material of the same cross-section and twice the length, to produce the same total field. Leakage means the magnet must be designed to produce from 20 to 50 per cent more total field to allow for what finds other routes than the small one between the pole-faces. Increasing gap spacing (magnetic length) increases the proportion of leakage flux due to fringing, *Fig.* 2, so the cross-section of the magnet must be increased, as well as its length, to maintain the same field in a gap that is twice as wide.

In the early days, the best speakers were energized, because permanent magnet materials were not one tenth as efficient as they are today. Then the value of a speaker was often judged by the watts dissipated in the energizing coil. When magnet materials improved

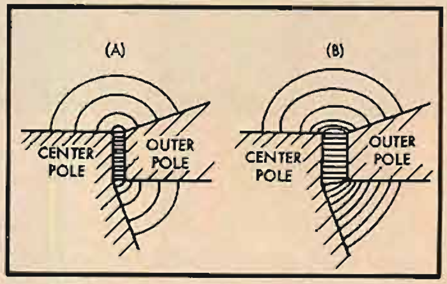

Fig. 2. Why increasing the gap spacing is doubly wasteful: (A) is a narrow gap, allowing small leakage flux; (B) is a gap twice as wide as (A), with the same density in the gap, requiring twice the magnet length to achieve it; but the greatly increased leakage flux surrounding the larger gap means magnet area must be increased too.

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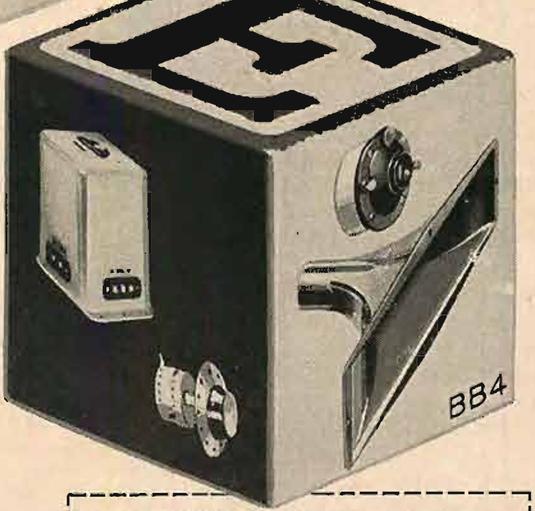

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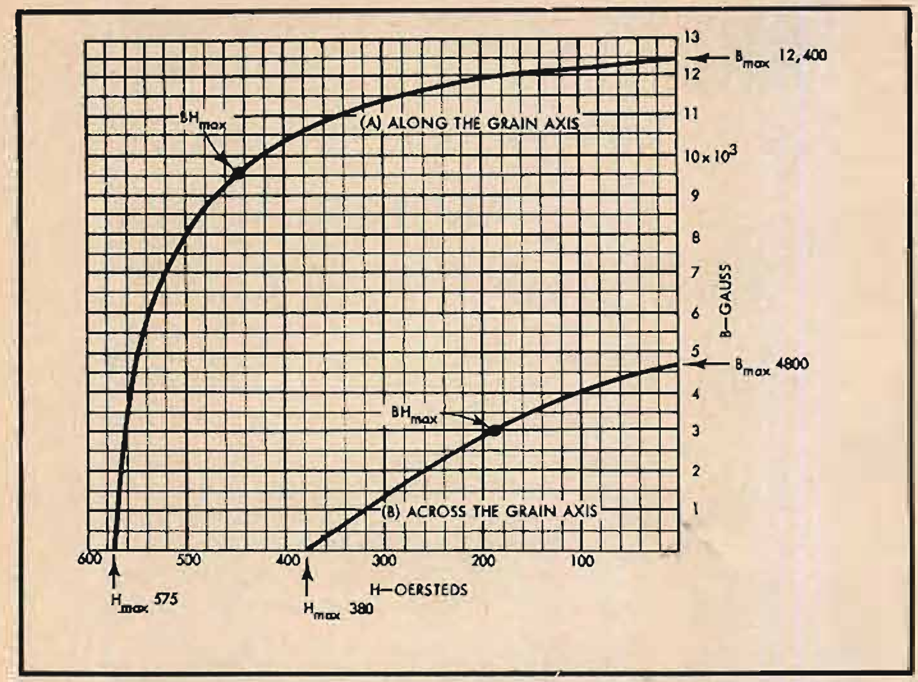

Fig. 3. Demagnetization curves for an early sample of Anico V type material: (A), magnetization along the grain alignment and (B), magnetization across the axis.

so the energized speaker was no longer economic, the "goodness factor" became magnet weight. A speaker with a 2-pound magnet should be twice as good as one with a 1-pound magnet.

Such a rough principle is only true *if* (a), both speakers employ a gap of the same volume, (b), both speakers employ the same magnet material, and (c), the magnets are properly matched to the gap in each case.

However, the fact remains that, other things being optimized, performance of a speaker can be improved by using either (a) better magnet material, or (b) more of a specific magnet material.

Transducer Efficiency

The loudspeaker magnet structure can contribute to transducer efficiency in two ways: (1) by affecting the electrical efficiency and (2) by affecting the electromechanical efficiency.

For maximum electrical efficiency, especially in the upper frequency range, the part of the pole faces nearest the voice coil should be saturated. Failure to saturate results in fluctuations in magnetization induced by voice coil currents, which cause losses that have to be supplied by the audio circuit. It also results in a high voice-coil inductance, so less drive current is available at higher frequencies from a low-impedance (high-damping-factor) source.

The drive force acting upon the coil is a function of current and the number of turns in the coil, and the magnetic field strength. Thus a magnetic field of maximum strength will result in maximum drive force for the audio current supplied. The voltage induced across the coil is a function of coil motion and the magnetic field strength again. So increasing magnetic field in which the coil operates improves the efficiency of transfer from electrical to mechanical energy.

A subsidiary advantage of improving the transducer efficiency is the greater flexibility achieved in applying proper damping for lower frequency resonance effects. With low-efficiency transduction, only acoustic damping is of any value. Electrical damping exerts little control of cone movement, because of the low efficiency. The higher the efficiency, the more effective electrical damping can be, and the more readily combinations of acoustic and electrical damping can be applied.

Progress

The production of more efficient magnet materials has always been beneficial to designers. When a new material first comes on the market, it is costly, so its use may not immediately show a cost saving. But it will show a possible weight saving. This is of particular advantage for portable uses, but weight reduction has other advantages. An overheavy magnet is difficult to secure against undue stresses that may pull the assembly out of alignment.

Unfortunately, use of inferior magnets can be covered up, to some extent, to those without a keen hearing for quality. Many manufacturers use earlier grades of Alnico than the Alnico V, with very much reduced efficiency. But they work and a few more electrical watts input makes the less expensive loudspeaker sound as *loud* as the more expensive one.

Often the extra watts are obtained unsuspectingly, by making the actual impedance of the voice coil less than half that of a good loudspeaker with the same nominal impedance. The lower impedance draws more current from the amplifier at the same voltage output, so greater watts are drawn, even on a direct A-B test. But loudness is not quality, as any high fidelity enthusiast knows.

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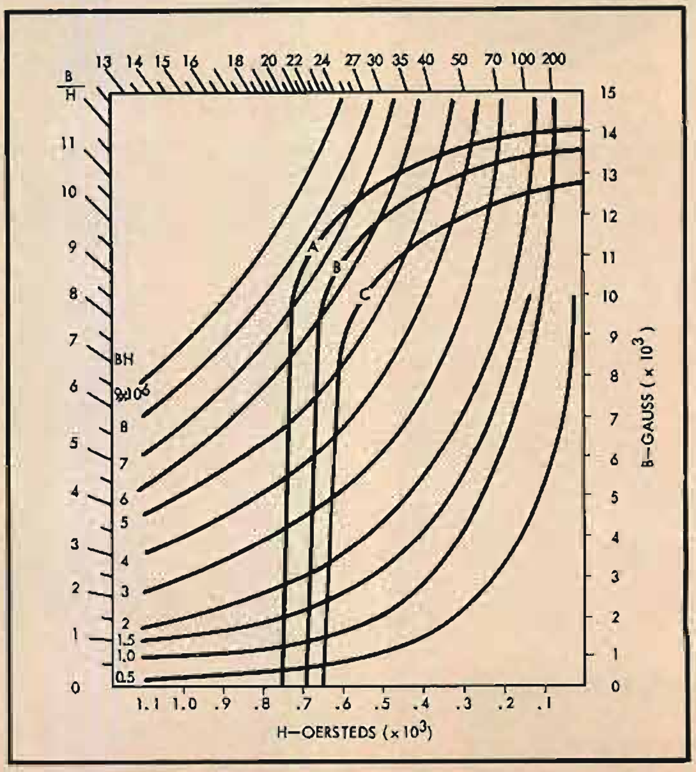

Fig. 4. Demagnetization and Energy Product curves of USM-75, (A), and USM-65, (B), as compared to Alnico V, (C). Marked improvements such as indicated in the energy levels of Alnicus grades USM-75 and USM-65 make possible the extension of design possibilities in all industries and in military and defense fields.

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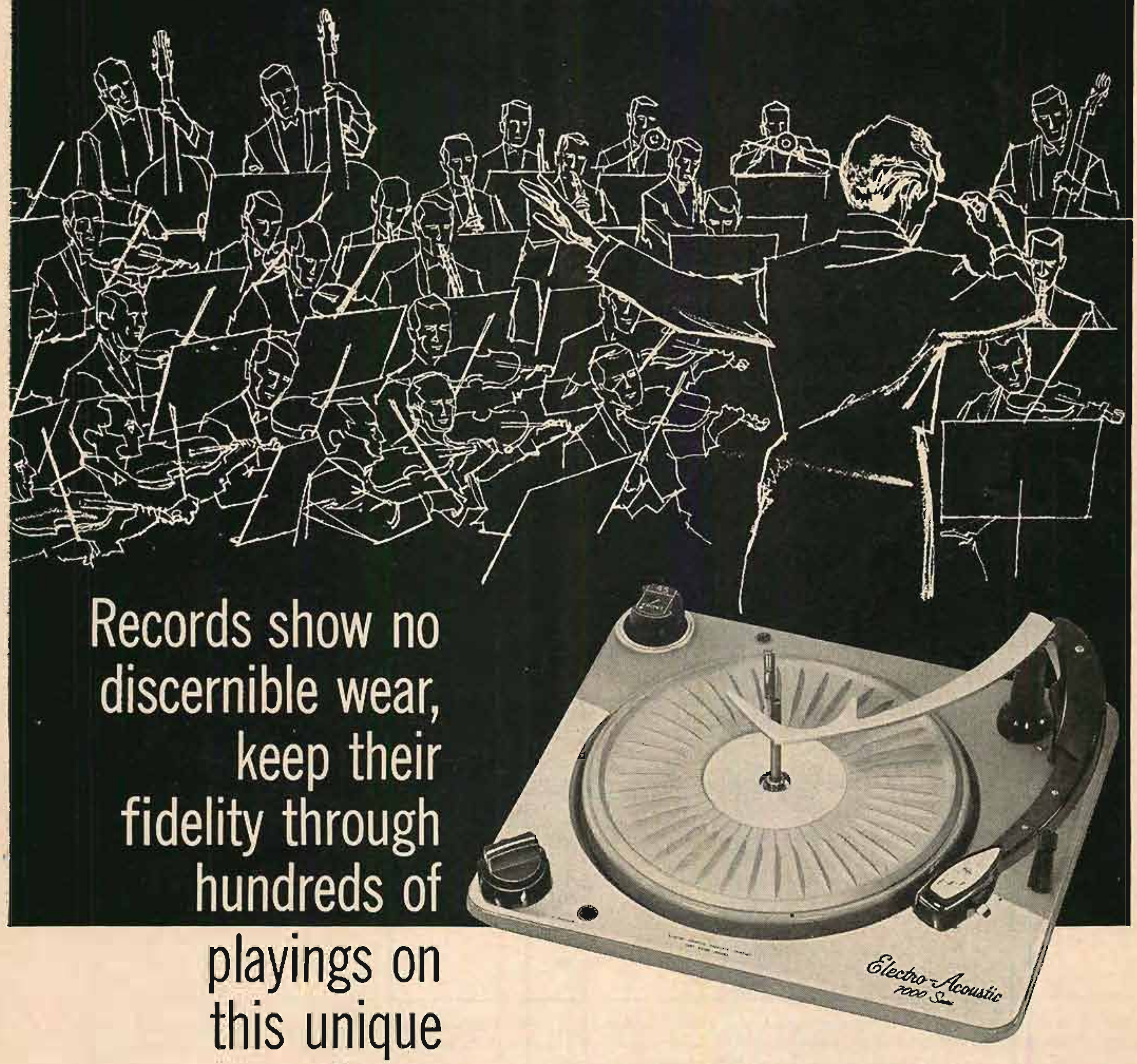

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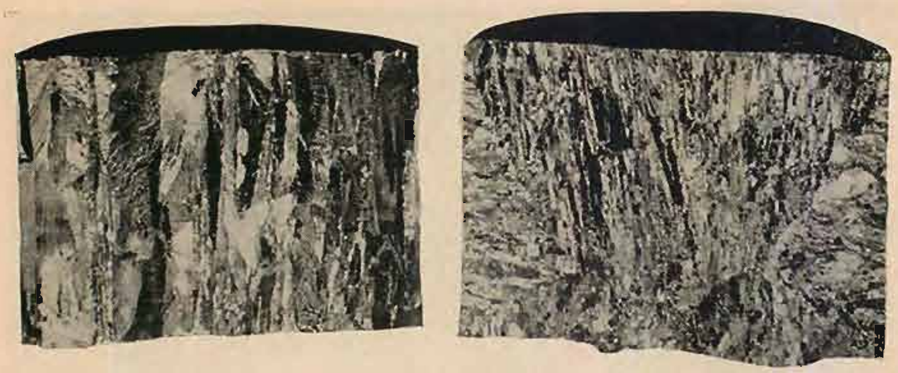

Unretouched photos of a cross section of an Alnicus grade USM-75 magnet at left and of Alnico V-DG magnet at right. Note the 100 per cent penetration and directional grain over the entire cross section of the Alnicus sample, compared with the random arrangement in Alnico. Grain orientation leaves practically no grain boundaries to effect losses in the energy product level.

least use an Alnico V magnet, in a design that closely matches the air gap, to give a reasonably high field density and saturate the pole faces adjacent to the voice coil.

One of the problems with Alnico V has been quality control. A specially handled sample may yield 20 per cent more BH_{max} than production quantities of the same magnet will average. This has been the cause of loss in performance in some of the better loudspeakers.

Recent research by U. S. Magnet and Alloy Corp., has come up with a new process that can satisfactorily be applied to production magnets, without excessive cost. This avoids the failure of production runs to conform with hand-made samples. This difference can be explained with a little magnetic theory.

Theory of Modern Magnetic Materials

Different magnetic materials have different intrinsic magnetization densities. This is the magnetization density of an almost infinitesimal domain of molecules, all oriented with their magnetic axis in the same direction.

Where the magnetic material has such domains randomly oriented, the magnetization density that can be induced is almost the same in any direction, but it falls far short of the intrinsic density for the material, because only a few of the domains are oriented in any one required direction.

Changing the alloy composition changes the intrinsic magnetization density, and certain fairly critical compositions are capable of very high magnetization. But to utilize this potential, the molecular domains need orienting in the "required" direction, an effect achieved by annealing, or cooling the magnet in a powerful magnetic field, aligned in the right direction, from the high temperature where its magnetic effect vanishes.

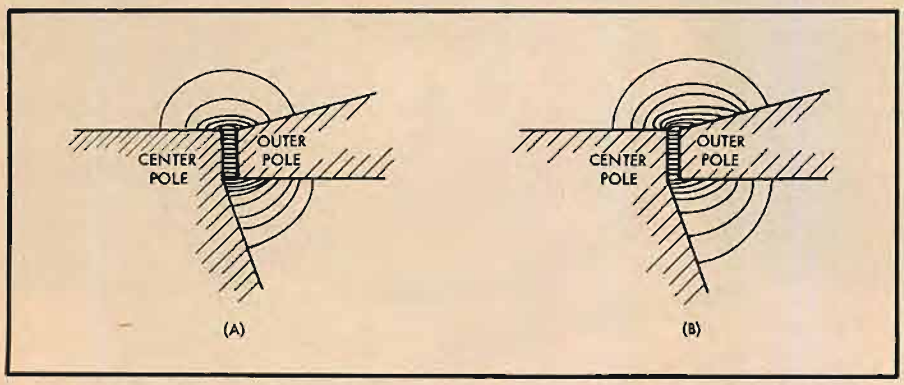

Fig. 5. Increasing the strength of magnet (e.g. from Alnico V to one of the Alnicus materials) will not materially increase density in the gap, if this is already saturated (A); it merely extends the area of leakage flux (B).

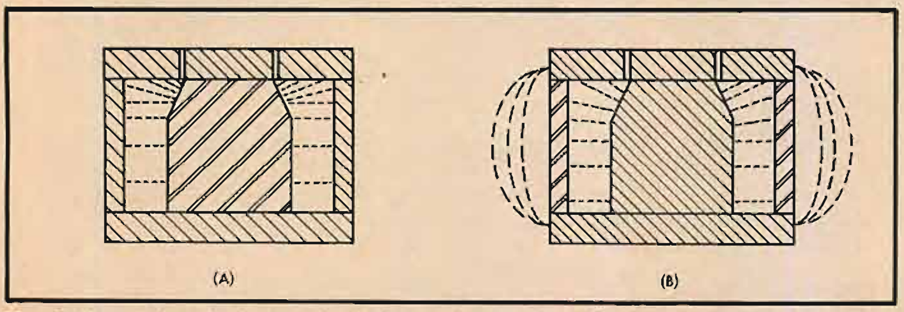

Fig. 6. Comparison between the leakage flux paths to be considered in design of a slug magnet (A) or a ring magnet (B); each is a cross-section through a magnet of the same dimensions, but with the magnet in the different position.

After such alignment, the magnet will achieve much higher BH_{max} energies in the chosen direction than in directions at right angles thereto. If the domains were fully aligned in a material, it would be almost non-magnetic in a direction precisely at right angles to the direction of alignment.

Early materials of the Alnico type achieve about 40 per cent of the B_{max} and about 60 per cent of the coercivity across the grain as compared with along it (*Fig.* 3). The BH_{max} product is about 25 per cent. From this, we would estimate that the domains are about 70 per cent aligned. This is not a high figure, because random arrangement can be regarded as yielding from 25 to 30 per cent alignment in any major direction, according to the composition of the alloy.

It should be possible to do better, and achieve at least 15 per cent greater B_{max}, with higher values of the other quantities. This the U. S. Magnet and Alloy Corporation have closely approached with Alnicus, a superior high-energy magnet commercially produced through an exclusive process known as Penegrane. Coming close to 100 per cent alignment of domains, their Alnicus USM-75 achieves a B_{max} of 13.9 kilogauss, as compared with 12.7 kilogauss for a good sample of Alnico V. Alnicus grade USM-65 achieves 13.5 kilogauss.

As coercive force also improves with the tighter grain structure, the BH_{max} improvement, which is what relates magnet weight to volume of gap to be filled with magnetic field, is even greater (*Fig.* 4). For a favorable figure for Alnico V of 5.5×10^6, USM-65 raises this to 6.5×10^6 and USM-75 to 7.5×10^6. The B/H ratio for BH_{max} is essentially the same for all three—between 19 and 20. This means either grade of Alnicus may be substituted directly for Alnico V with considerable increase in magnetic energy available.

Applying the Improvement

Alternatively—and this is probably the most likely direction for improvement—magnets of smaller size and weight, but similar in proportion can be substituted, while maintaining the same performance.

A loudspeaker magnet assembly should always be fully designed, calculating the working densities at all points. If Alnico

(*Continued on page 87*)

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ALTEC 312A FM TUNER—Max. Sens.: 2 mv (equivalent to 1.0 mv, ref. 72 ohm antenna). Quiet. Sens.: 2.9 mv for 20 db (equivalent to 1.45 mv, ref. 72 ohm antenna). Freq. Response: ± 2 db, 20-20,000 cps. Distortion: less than 2% @ 100% mod. & @ 1 v output. Dimensions: 5½" H x 15" W x 9" D.

ALTEC 309A AM/FM STEREO TUNER—FM-Max. Sens. & Quiet. Sens.: Same as 312A above. Freq. Response: ± 1 db, 20-20,000 cps. AM-Max. Sens.: 3.2 mv. Loop Sens.: 35.0 mv per meter. Dimen.: 5½" H x 15" W x 10⅝" D.

ALTEC 353A STEREO AMPLIFIER-PREAMPLIFIER — Inputs: 14, stereo or mono. Outputs: 6, stereo or mono. Matricing network for 3-channel stereo & auxiliary speakers. Power Output: 100 watts, stereo prog. pk.; 50 watts, rms. contin. Freq. Response: ±1 db, 20-20,000 cps @ 25 watts; ± 0.5 db, 10-30,000 cps @ 1 watt. Distort.: Less than 1% THD @ 25 watts, 1000 cps ea. channel; less than 1% THD @ 20 watts, 30-15,000 cps ea. channel. Dimen: 5½" H x 15" W x 11¼" D.

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1515 South Manchester Ave., Anaheim, Calif.
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Switching—Mono to Stereo, to Stereo Plus Center

HAROLD REED*

Devising a switching system capable of handling a large number of microphone inputs monophonically or stereophonically is relatively simple. It is not so simple, however, to match, mix, and maintain signal level. Here's one way of doing it.

An audio system comprising a multiplicity of microphone inputs may be used monophonically or stereophonically by providing suitable switching facilities. But switching is only part of the story. There are three other considerations—matching, mixing, and signal levels. Matching of impedances provides maximum power transfer and avoids the possibility of waveform distortion. Mixing, on the other hand, results in undesirable but unavoidable losses. Signal levels should be kept nearly the same so the attenuators will "ride" at about the same spot, say mid-position, when switching the input circuits.

Impedance matching and mixing may be accomplished by using conventional fixed pads and resistive networks such as the branching configurations shown in *Fig.* 1. Although (A) and (B) in *Fig.* 1 show networks that will handle only three channels these will serve to indicate the complex switching circuitry that would be required to keep everything matched and terminated when splitting the channels for various modes of operation and especially when using the eight-input system to be discussed.

It would be desirable, therefore, to try to satisfy the same matching, mixing, and level requirements with fewer circuit elements than needed for these commonly used networks. This may be done by first giving a little thought to the input and output impedances of the monophonic-stereo system involved and the mode of operation that will cause the greatest loss.

Three-channel, Eight-input System

As an example, let us set up circuits for a system accommodating up to eight microphone inputs that may be employed in three different modes of operation; namely, eight monophonically, four and four stereophonically, and three and three stereophonically plus two stereo center. The circuit diagram is given in *Fig.* 2. These input circuits could not be switched in and out indiscriminately without having serious mismatching and varying signal levels requiring different attenuator settings for any given input signal level when going from one mode of operation to another.

Greatest signal loss in any one channel will occur when all input circuits are used monophonically. This, then, is the starting point in our attempt to match, mix, and hold signals at a nearly constant operating level without having widely different operating positions of the attenuators.

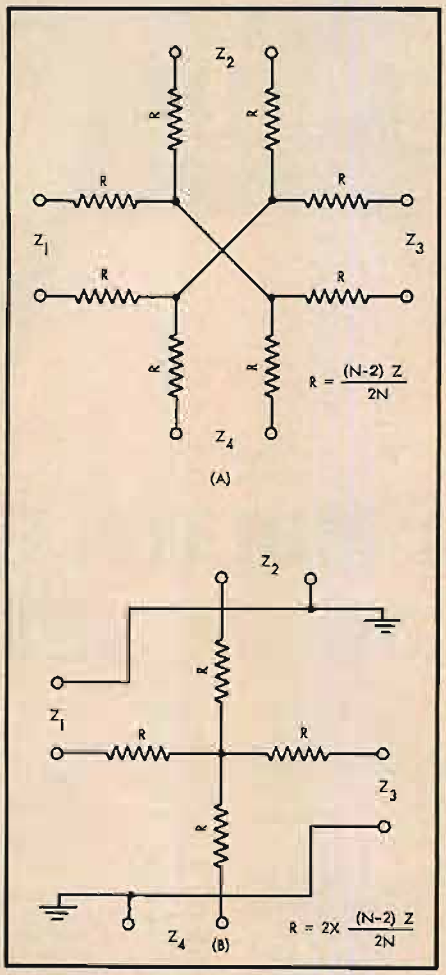

Fig. 1. (A) Conventional, balanced, mixing-matching network. Handles only 3 inputs; for each additional input 2 more resistors are needed. Complex switching results. (B) Unbalanced mixing network with one less resistor in each leg. All legs work into the same Z. To change the number of channels, all the R values must be changed. Switching still complex.

Mixing, and therefore matching, is done in this circuit immediately after the input attenuators. Here, each attenuator works into a single series resistor, labelled R_1 *to* R_8. The mixed signals are then applied to the line amplifier input through switch S_1. Switch S_2 allows the eight circuits to be fed to the left or right line amplifier as desired.

Equivalent Mono Mixing Circuit

For purposes of analysis, the monophonic mixing circuit is redrawn in *Fig.* 3. The 600-ohm resistors represent the input attenuators. Now, what impedance does each attenuator see? What impedence is presented to the line amplifier input and what is the mixing loss?

Let us consider attenuator R_9 in *Fig.* 3 with the arrows pointing away from it. Any one of the eight attenuators, however, could have been selected for this purpose. Now, R_2 and R_{10} in series, 525 and 600 ohms, equal 1125 ohms. Starting with R_2 and R_{10} and through R_8 and R_{16} there are 7 of these series combinations in parallel. The equivalent resistance is 1125/7, or 161 ohms. Going further, the amplifier input, rated at 150 ohms, is also in parallel with these 7 legs of the network. The total effective parallel resistance is, therefore, $(161 \times 150)/(161 + 150)$, or 78 ohms. This value is in series with R_1 with respect to R_9. Thus, the load presented to R_9 is 78 + 525, or 603 ohms. This condition will hold for any of the eight attenuators.

Looking at the amplifier end of the network, the amplifier input will see eight 525- and 600-ohm series legs in parallel. The effective impedance presented to the amplifier is, then, $(525 + 600)/8$, or 141 ohms which is a close enough match for the amplifier.

Mixing loss is a function of the resis-

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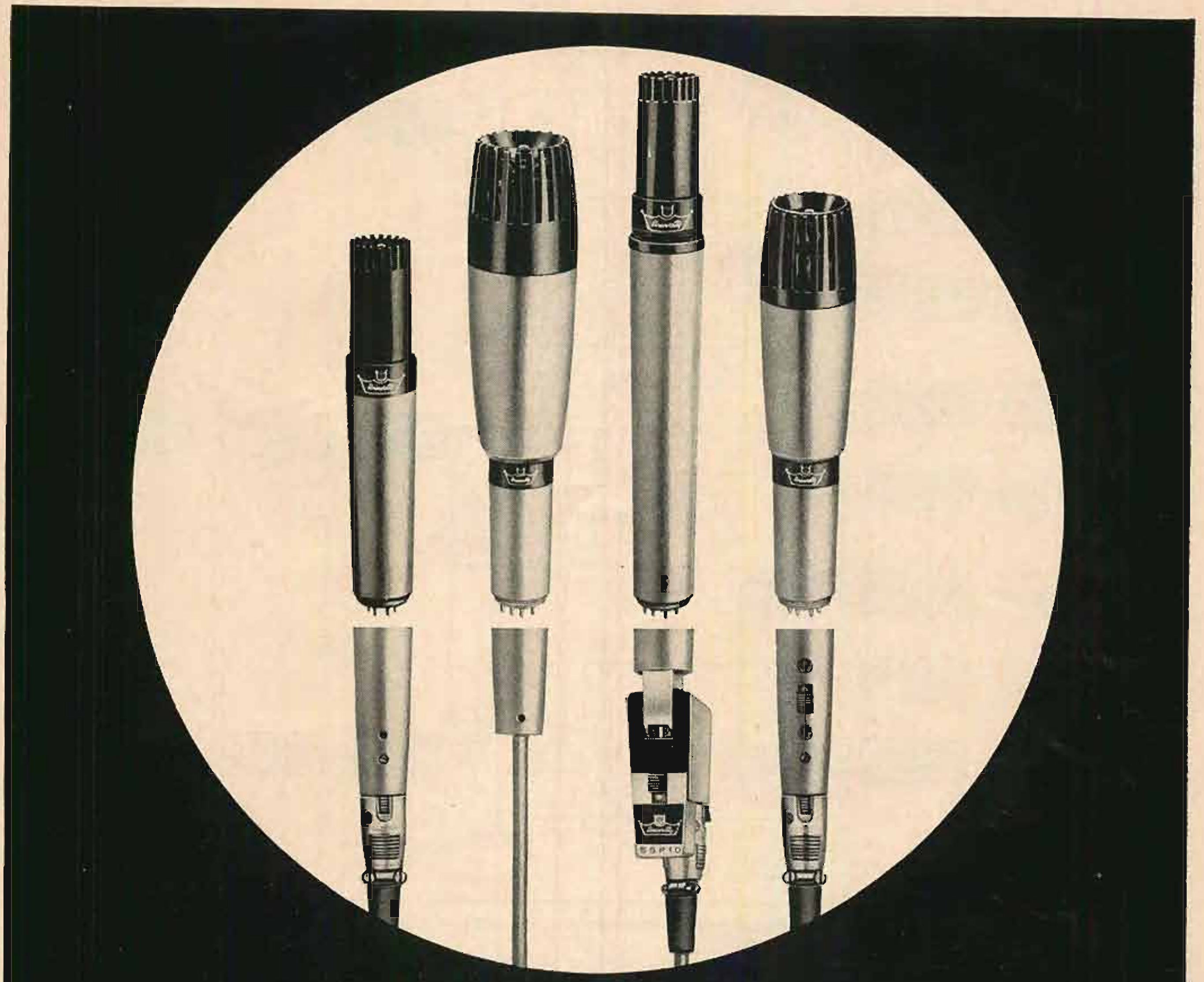
* *3917 Madison St., Hyattsville, Md.*



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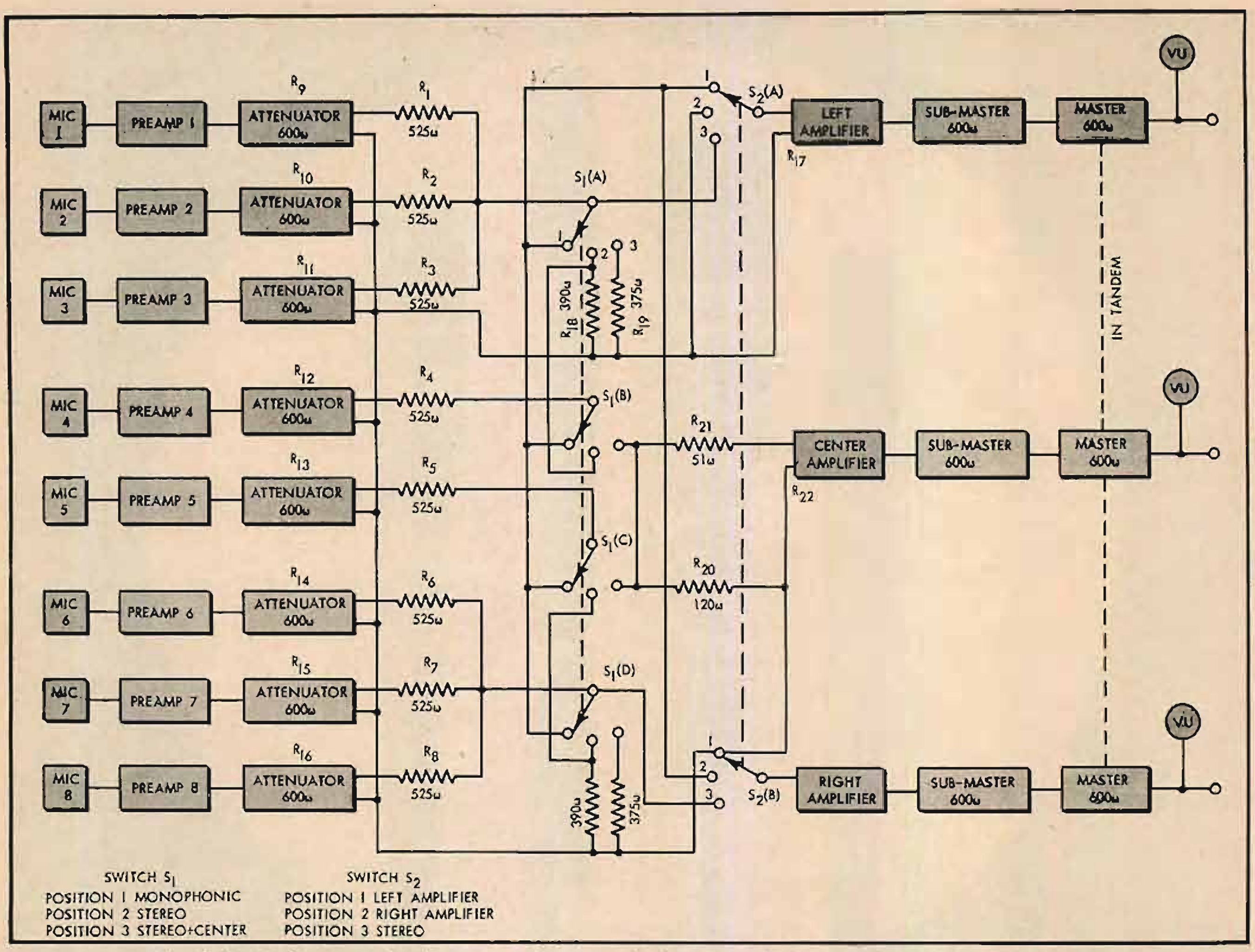

Fig. 2. Block diagram of audio system for monophonic, stereophonic, and stereophonic plus center.

tance ratio. Here, it is equal to 20 times the log of the ratio of the 525-ohm series sistor, R_1, and the total effective parallel resistance, 78 ohms. With this circuit it worked out to be 16.6 db.

Equivalent stereo network

Let us consider next the stereo mode with four microphone inputs to each channel. As mentioned previously, it is desired to hold the mixed signals at about the same level in any mode of operation and to retain reasonably good impedance matching. Again, to simplify analysis, the equivalent circuit is given in *Fig.* 4. The same 525-ohm series resistors are still used. A 390-ohm resistor, R_{18}, is now switched into the circuit. As before, let us find what R_9 sees. R_2 and R_{10} in series, $525 + 600 = 1125$ ohms. There are now three of these series legs starting from R_2, R_{10} through R_4, R_{12}. The parallel resistance here is 1125/3, or 375 ohms. This value in parallel with $R_{18} = (375 \times 390)/(375 + 390)$ or 191 ohms. And 191 ohms in parallel with the amplifier input impedance R_{17} gives a total effective resistance of $(191 \times 150)/(191 + 150)$, or 84 ohms. This is in series with R_1 as far as R_9 is concerned. Thus, the load presented to R_9 is $84 + 525$ which equals 609 ohms. As before, any of the attenuators will see this same load.

Each amplifier in this stereo mode will look into four series legs, R_1 and R_9 to R_4 and R_{12} in parallel plus the parallel resistance of R_{18}. Here, $(525 + 600)/4 = 281$ ohms. This in parallel with R_{18} equals $(281 \times 390)/(281 + 390)$ amounting to a value of 164 ohms, a close match for the amplifier input. Mixing loss, figured as before will be about 15.9 db, less than a db from the monophonic circuitry.

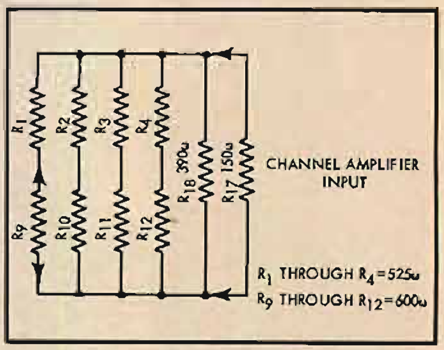

Fig. 4. Equivalent circuit of mixing-matching network of **Fig. 2** in the stereophonic mode. This indicates only one channel. The other channel duplicates this.

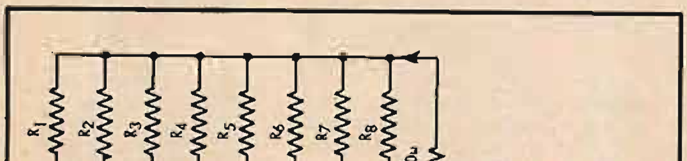

Fig. 3. Equivalent circuit of mixing-matching network of **Fig. 2** in the monophonic mode. The 600-ohm resistors are the input attenuators.

Stereo plus center circuit

We now come to the third mode of operation, stereo with three inputs each to channels 1 and 2 plus stereo center with two inputs to channel 3. The equiva-

(*Continued on page 91*)

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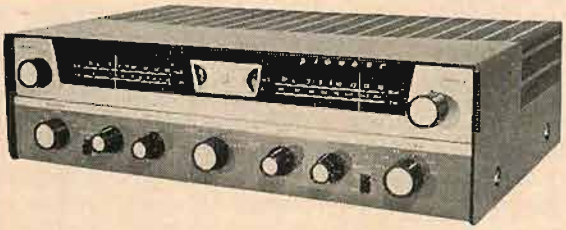

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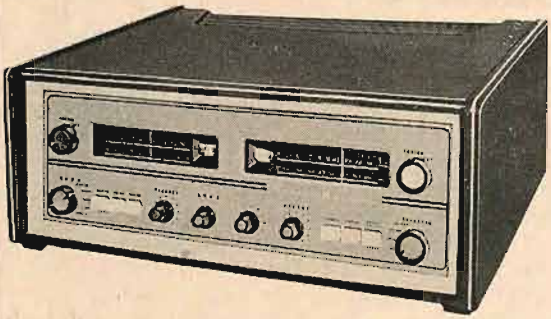

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SM-B200A

- * Built-in scratch filter and rumble filter have made it possible to enjoy beautiful noise-free music reproductions.
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- * This amplifier is provided with performances that are equal to three to four amplifiers of conventional type.

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One Step at a Time

BURT HINES*

The development of an audiofan is a rare and beautiful procedure. Here we are treated to a detailed account of the indoctrination of Clarence Smith; from wide-eyed innocence to rabid perfectionism.

Clarence Smith was under 30, he was a bachelor, he was wealthy, he liked music, he had a number of hi-fi enthusiasts among his acquaintances, and he lived alone in a large, old-fashioned apartment with thick soundproof walls. Add to this combination of circumstances a newly acquired interest in high fidelity, and the turn of events was perhaps inevitable. Yet the beginning was hardly one to suggest what was to follow.

One day, at the advice of Ned Green, he visited the audio salon frequented by Ned and sought out salesman Paul Slater. Clarence explained that he wanted nothing elaborate, just a simple audio system for background music. He brought home the speaker, the enclosure, and combination tuner-amplifier recommended by salesman Slater.

That night Ned Green made it his business to check on the results of his suggestion. He listened and nodded approval. Clarence's wish was fulfilled. But, he pointed out, a record changer and a tape recorder were desirable additions to complete the system. Clarence and salesman Slater saw to this the following day.

Next evening, Sam Eng, who occupied the apartment on the other side of the common wall, rang the bell to borrow a couple of eggs. Clarence asked him to stay and listen to his acquisition. "How do you like it?" Clarence asked.

"Very nice," Sam said. "However, may I ask a couple of questions? Wouldn't a transcription turntable produce more accurate pitch, steadier sound, and less rumble than a changer? And wouldn't it be wise to add a tweeter to your present speaker for full and clear reproduction of the high notes?"

Clarence stared at Sam with the sudden realization that there were depths to Sam he had never suspected. The following morning Clarence confronted salesman Slater with Sam's questions. Sam Eng was indubitably right, Slater agreed, but this meant going beyond Clarence's original request for a simple background music system. Slater sold Clarence a transcription turntable, an arm, a new cartridge, a tweeter, and a crossover network channeling the low notes to his existing speaker and the highs to the tweeter. He promised a full refund when Clarence returned the changer.

Harold Detwiler was the next to hear the system. Now and then Clarence took out Harold's sister, Clara. Harold had a reputation as a pro in hi-fi, and Clarence felt that for once Harold's opinion might be worth something.

As he listened, Harold prepared a mental list. He had decided that Clarence should have the truth, point by point and without mercy, but kindest in the long run. "Clarence," he began, "let's face it. You don't have a loudness control. Or a rumble filter. Or a scratch filter. Or a presence control. You have only two phono compensation curves. You don't have tape head equalization," he went on, disregarding the fact that the tape machine supplied its own equalization. "The power amplifier doesn't have a bias adjustment. It doesn't have a static balance adjustment. It doesn't have variable damping. It is rated at 15 watts, and it should turn out 50. You should have a separate preamplifier and power amplifier for top quality and flexibility. You should get a separate FM tuner for the same reasons." Harold glowed with the satisfaction of having done justice to the role of hi-fi pro.

Clarence gaped at Harold. "Would you mind writing all that down?"

"Not in the least," Harold replied.

Salesman Slater was waiting on a customer when Clarence entered the audio salon the following day, but promptly turned him over to a colleague as Clarence approached. He meditated over the list Clarence submitted. "I guess you want the best after all," Slater said.

"Might as well."

The excitement underneath Clarence's laconic remark was obvious to Slater's experienced ears. Slater translated the list into equipment. He sold Clarence a preamplifier, a power amplifier, and an FM tuner, each generally acknowleged by connoisseurs as having no superior.

Clarence enjoyed his hi-fi system and respite from visitors for a week, when Victor Berlioz dropped in. Clarence greeted him with mixed feelings. Victor had the reputation of a pro in hi-fi, and Clarence suspected that more things would happen to his audio system as the result of this visit. At the same time Clarence felt the renewed excitement of probing further into the mysteries of audio.

Victor Berlioz listend a minute. He threw Clarence a plum and grabbed it back in mid-air. "You have a fine system there," he said, "but it could be better."

Victor continued. "I am talking about a subtle difference, but a worthwhile one. Make yours a biamplifier system. Use separate power amplifiers for the woofer and the tweeter. Instead of using a crossover network to divide the lows and highs between the speakers, use an electronic crossover to divide them between the amplifiers. *Then* you will have clean sound."

"Where have you been keeping yourself?" salesman Slater greeted Clarence the next day. He examined the notes Clarence had made during Victor Berlioz's visit. "I must say this is a good idea in view of the equipment you already have. After all, the best deserves the best." Clarence took home another power amplifier and an electronic crossover.

Clarence invited Harold Detwiler back to note how fully his advice had been followed and even exceeded.

Harold listened long and intently. "Clarence," he said slowly and with the simplicity reserved for great achievements, "I like it." Clarence restrained tears of joy. Harold resumed listening, seemingly enraptured by the sound. But the instincts of the pro, temporarily submerged, were working to the surface.

"Clarence, you need a better speaker system," he said at last. "The rest of your equipment is too good for the speaker you have now. Get a three-way system, with woofer, mid-range speaker, and tweeter. Get the best. This may cost you $500 or more, but it's worth it. You want to *feel* the bass. You want to hear the scrape of rosin on the violin strings. You want a soloist right in the room with you. Keep in mind that a three-way speaker will require a triamplifier instead of biamplifier system. So you will have to add another electronic crossover and another power amplifier. Clear?"

"Clear."

Mindful of the past volume of busi-

(*Continued on page 88*)

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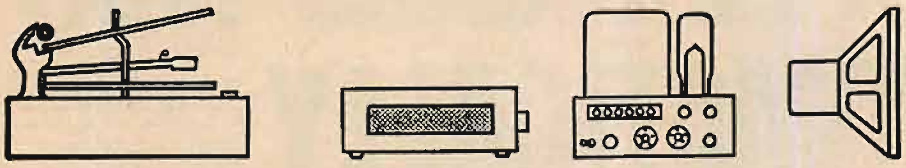

MIRACORD STUDIO H TURNTABLE-RECORD CHANGER

In the past year or so a new breed of "animal" professing to be both fish and fowl has become fairly populous in the haunts frequented by the audiofan. This new "animal" is, of course, the turntable-changer. Here, in one instrument is combined the convenience of the automatic record changer with the record-handling accuracy of the turntable plus tone arm. Certainly, this is an attractive combination and if it were true without reservation we would soon see the end of the turntable-plus-tone-arm "fowl." However, these hybrids cannot really supplant the high-quality turntable-tone arm combination. The fact of the matter is that in order to operate as a record changer certain compromises are necessary which will inevitably make the over-all performance less accurate than the sum of its parts. On the other hand, a well-designed unit of the new breed can provide a level of performance far and away beyond the ordinary record changer and come very close to the level of the turntable plus tone arm.

The Miracord Studio H is a well-designed unit.

A four-speed machine, the Studio H features pushbutton record-size selection and automatic operation in both the manual and record changer modes. In addition it is supplied with an automatic as well as a manual spindle plus a stylus-force gauge which consists of a removable calibrated weight. It can handle up to ten records automatically providing they are all of the same diameter. On the base provided, the Studio H requires a compartment with inside dimensions 14-in. deep, 17½ in. wide (the base is actually only 16¼-in. wide but the arm overhangs the additional 1¼-in.), and 10-in. high. In appearance the Studio H is a rather striking design in gray, black, and chrome mounted on a mahogany base. It *looks* as if it would perform well; in reality it does.

The Changer Mechanism

The record-changing mechanism in the Miracord Studio H is not essentially new—the Magic Wand was used on previous Miracord record changers. In operation, one merely piles as many same-size records as possible up to the red band on the spindle, and presses the button corresponding to the record size. Then the mechanism automatically drops a record in position, lifts the arm off the rest, places it in the lead-in groove of the record, and, when the record is over, returns the arm to the rest so that the cycle may be repeated if there is another record on the spindle.

When a record is placed on the spindle it rests on three fingers which are pulled into the spindle in order to permit the record to drop down to the turntable. At the same time, three different fingers higher up on the spindle are extended to prevent more than one record from dropping. A shaft running through the hollow spindle effects the results described above. Operation of this system is unusually simple and apparently foolproof.

The change cycle is controlled by means of a rather intricate and large cam, which in turn is set in motion by the rotation of the turntable platter. In cycle, the mechanism handles the tone arm and the record gently except for the inevitable "plop" when the record is dropped onto the platter. The procedure is smooth and unusually noiseless when compared to most changer mechanisms—usually one hears a series of clicks, snaps, and pops preceding the release of the record.

Driving the Turntable

The platter of the Studio H is driven by a hysteresis-synchronous motor manufactured in Germany by Papst, a well known manufacturer of quality motors. This motor is slightly unusual in that the rotating element is the outer case, and the field coils are mounted on the stationary "armature." We are not familiar with the relative virtues of this arrangement but it is rather disconcerting when viewed for the first time. In any case, the platter is driven by means of a rubber-surfaced idler which contacts both the motor spindle and the inner rim of the platter. The motor spindle is four-stepped to correspond to the four speeds offered, and speed change is effected by changing the height of the idler to that of the appropriate spindle step. The motor is mounted by means of three rubber bushings to isolate it from the turntable.

The turntable platter is a one-piece casting which is dynamically balanced and weighs almost 7 lb. It is 12-in. in diameter.

The Arm

The arm on the Studio H utilizes ball bearings for the horizontal plane and canted pivots for the vertical plane of motion. The arm is counter-weighted and balanced by means of a sliding weight. Stylus force is adjusted by means of a small calibrated weight used while the arm is being balanced. The weight is calibrated for stylus forces from 2 to 6 grams.

Although the arm is automatically placed into the lead-in groove of the record and lifted off after the record has been played, during the period that the record is being tracked the arm is disengaged from the changing mechanism. The arm is fabricated from rectangular metal tubing and

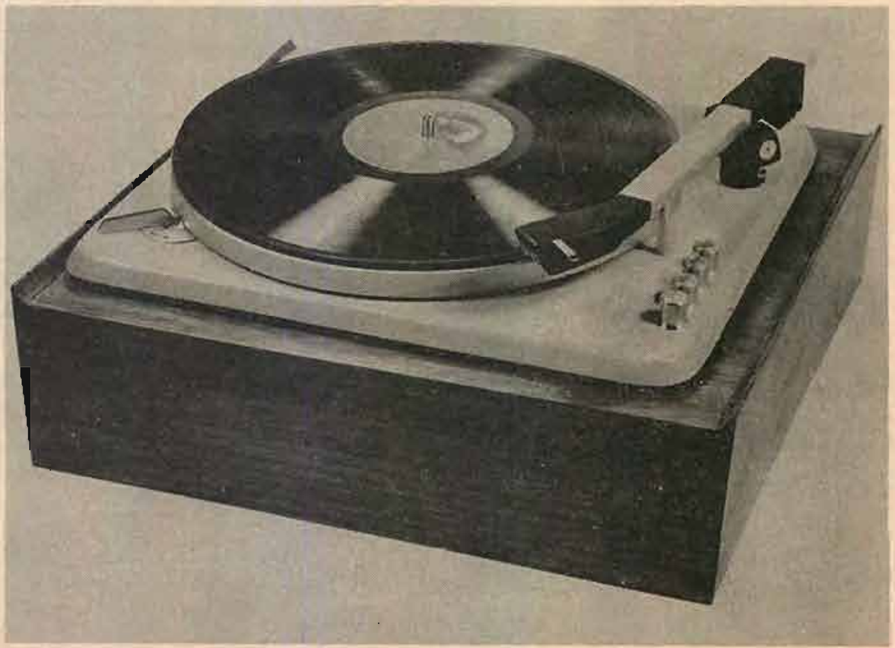

Fig. 1. Miracord Studio H turntable-changer.

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Aristrocrat of bookshelf-size speaker systems, the JBL Ranger-Minigon provides integrated stereo through radial refraction, the same patented method used in the fabulous JBL Ranger-Paragon. Minigons accommodate either LE8 full-range units or JBL Model S5 two-way systems. Grille may be either the unique louver assembly shown here or fabric.

THE MADISON

THE DALE

THE JBL MADISON

An exquisitely-styled minimum volume enclosure, the Madison reflects the Danish design influence and is especially popular in oiled teak or walnut finish. Finished four sides and front for vertical or horizontal placement. Takes the LE8 speaker or S5 system.

THE JBL DALE

A timeless, elegant, modern design with removable legs and hangers on back (also on Madison) for wall mounting. Finished four sides and front. All finishes and grille cloths available.

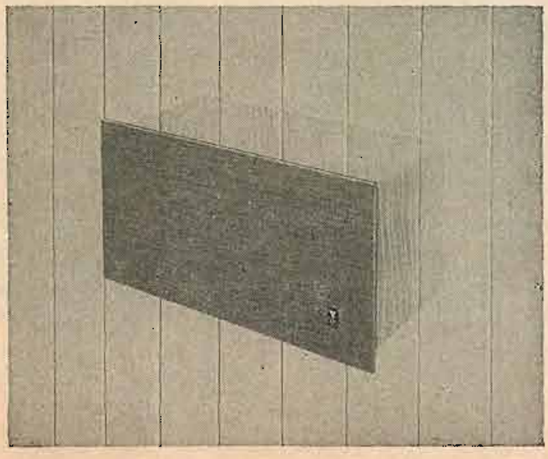
HIGH QUALITY, LOW COST COMPACT LINEAR-EFFICIENCY SYSTEMS

THE LANCER 33

It is possible to offer typical JBL precision response, fine cabinet craftsmanship, and lasting-listening satisfaction at a lower price than ever before by making a simplified enclosure, longer production runs, limiting choice of finishes, using one grille, and providing somewhat less flexibility. The Lancer 33 is a ducted acoustical enclosure with an LE8 eight-inch, full range speaker. Lancer finishes are those most frequently asked for—tawny walnut, oiled walnut, dark mahogany, ebony, and pumice. Grille cloth is beige linen-weave.

THE LANCER 66

Similar in appearance to the 33, the Lancer 66 is a "buttoned-up" enclosure with a two-way, dividing network system with an LE 10 and new high frequency unit. Performance is remarkably smooth and transparent. Lancer speakers are factory installed.



and for building in...

THE JBL WILTON

Unfinished, the Wilton is furnished with either the LE8 or S5 system factory installed. Offered with either a flush grille or overlapping grille for use when built into a wall or partition.

Whatever your choice... exponentially-tapered horn, bass reflex or infinite baffle system... you'll find your ideal speaker in the extensive JBL line. Write for complete catalogue.

JBL products are manufactured by James B. Lansing Sound, Inc., and marketed by
JBL INTERNATIONAL Los Angeles 39, Calif.

the plug-in head is metal and appears to be die cast. Over-all the arm seems to be of superior construction, certainly comparable to many component arms.

Performance

Evaluated as an automatic record changer, the Miracord Studio H is definitely in the top rank; there are just no ordinary changers we have encountered which are better. Of course, the Studio H does not intermix various record sizes and it requires much more space than the ordinary record changer—in fact as much space as the ordinary turntable.

Operating as a turntable the Studio H performs well: it can track with a stylus force of 2 grams; wow and flutter are less than 0.3 per cent; speed is constant. On the other hand, in common with all turntable-charger combinations it suffers from what may be called record-charger geometry; the necessity to track records at both extremes of the pile with reasonable accuracy, in spite of a different in height of perhaps ½-in. Obviously, if the first record is tracked exactly as it should be, then the other records will be tracked increasingly poorly as the height increases; a poor compromise for a record changer. Conversely, if the first record is not chosen, then turntable performance must suffer. This dilemma is usually solved by a compromise—neither the first record nor the last can be optimum on any record changer.

Another consequence of record-changer geometry is the need for higher tracking forces to compensate for those records with the worst geometry.

In summation, the Miracord Studio H is an excellent record changer and a good turntable, although it is limited in the latter function by the former. It is an excellent choice for those who require a changer with turntable characteristics. J-20

KORTING MODEL 158S STEREO TAPE RECORDER

There is something about tape recorders made in Europe which immediately communicates their other-than-U. S. birthplace. Perhaps it is the extreme attention to detail, or the absence of unnecessary chrome, or maybe it is simply that they use finishes and materials not available in this country. In any case the Korting is made in Western Germany, and unmistakably so. But appearance is not the only way in which this machine differs from others—it also incorporates a variety of unusual functions. These include the ability to make multiple synchronized recordings (monophonically) and facilities for reverberation and echo effects (also monophonically).

First, let us start from the beginning. The Korting 158S is a 2-speed (3¾ and 7½ ips), 4-track, stereo tape recorder which incorporates a third head to accomplish the unusual functions mentioned previously. A recording-level indicator (eye tube) visually shows the level of either channel during monophonic recording, or the strongest signal during stereophonic recording. Color coding is utilized to provide a visual key to the controls related to the separate channels. Thus the record button, playback button, and volume control for the left channel are all green. Similarly the right channel uses red.

The 158S records stereo and provides jacks for either a single-unit stereo microphone or two separate microphones. It also records mono (four tracks). Direct tape monitoring is possible during monophonic recording through the built-in speakers. The Korting 158S is a moderately priced unit intended for the home recordist and would be an excellent choice for those audiofans desirous of creating unusual recordings.

The Mechanism

The motor driving the capstan and take-up turntable is a hysteresis-synchronous unit. It is connected to a pulley by means of a round plastic belt. The pulley, in turn, is connected by a similar belt to a heavy, balanced flywheel on which the capstan is mounted. The take-up turntable is driven by the same belt as the pulley. This system of belts is usually accurate and trouble free as long as the belts do not stretch excessively. Several European machines use belts of this kind so that it is likely that they do not stretch overmuch.

The method for guiding and handling the tape in the area of the heads is extremely well conceived. There are four machined guides which locate the tape in proper relationship to the heads. On the other side of the tape there are two pressure pads, one each for the recording and playback heads, and a rubber roller which presses the tape against the capstan. The latter three units are mounted on a fairly heavy metal U-beam which is pivoted on one end. When the U-beam is rotated toward the heads, firm and positive contact is achieved. Tape motion is controlled by four pushbuttons at the front of the deck.

Speed change is effected electrically rather than mechanically. This is easy to do because the motor is of the hysteresis-synchronous type and the ratio of the speeds (2 to 1) is suited for it. Actually electrical speed change is a distinct advantage and strength; not only are there fewer mechanical parts to worry about but also this type of motor is inherently accurate at both speeds.

Circuit Description

There are several rather unusual features in this circuit. First of all the initial stage of the preamplifier is a transistor, an OC44, and all the remaining stages utilize tubes. This arrangement takes advantage of the virtues of both the transistor and the tube.

Another unusual feature of this circuit is the method for direct tape monitoring during monophonic recording. Essentially the method involves feeding the output of the playback head corresponding to the recording head being used to the opposite playback amplifier. For example, if the left recording head is being operated, the output of the left playback head (the playback heads follow the recording heads) is fed to the right playback amplifier. The method for accomplishing this is two little 4-pin plugs located on sockets behind the playback head. The plug orientation is rotated 90 deg. and that is all there is to it. Of course, it would be much easier if a switch were used for this purpose.

The synchronous dubbing and reverbration functions make use of an ingenious mixing control which sends the signal from a recorded channel (while it is being played back) to the other channels recording head.

Performance

The mechanical system of the Korting 158S performs very well: wow and flutter at 7½ ips are less than 0.2 per cent; tape handling is extremely smooth and gentle;

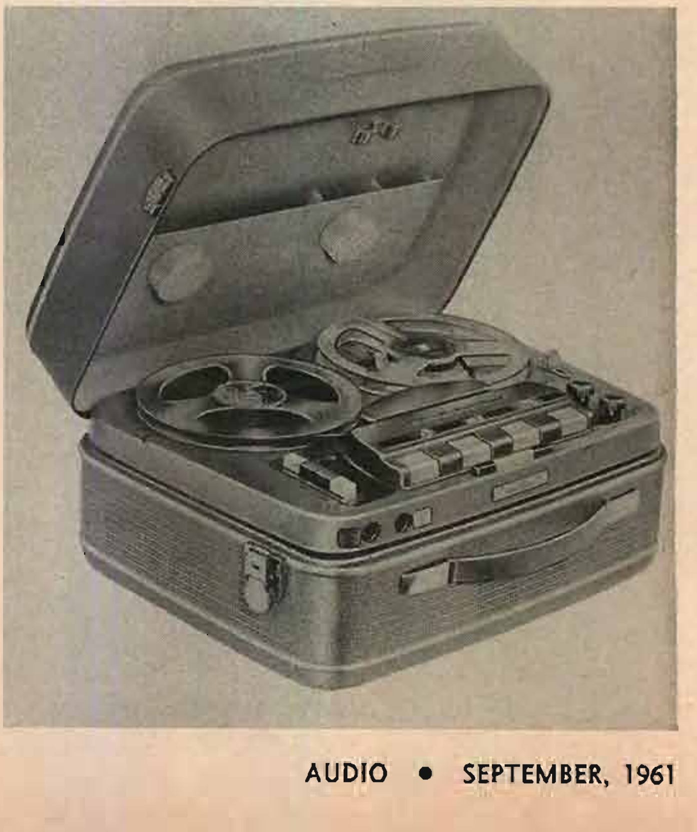
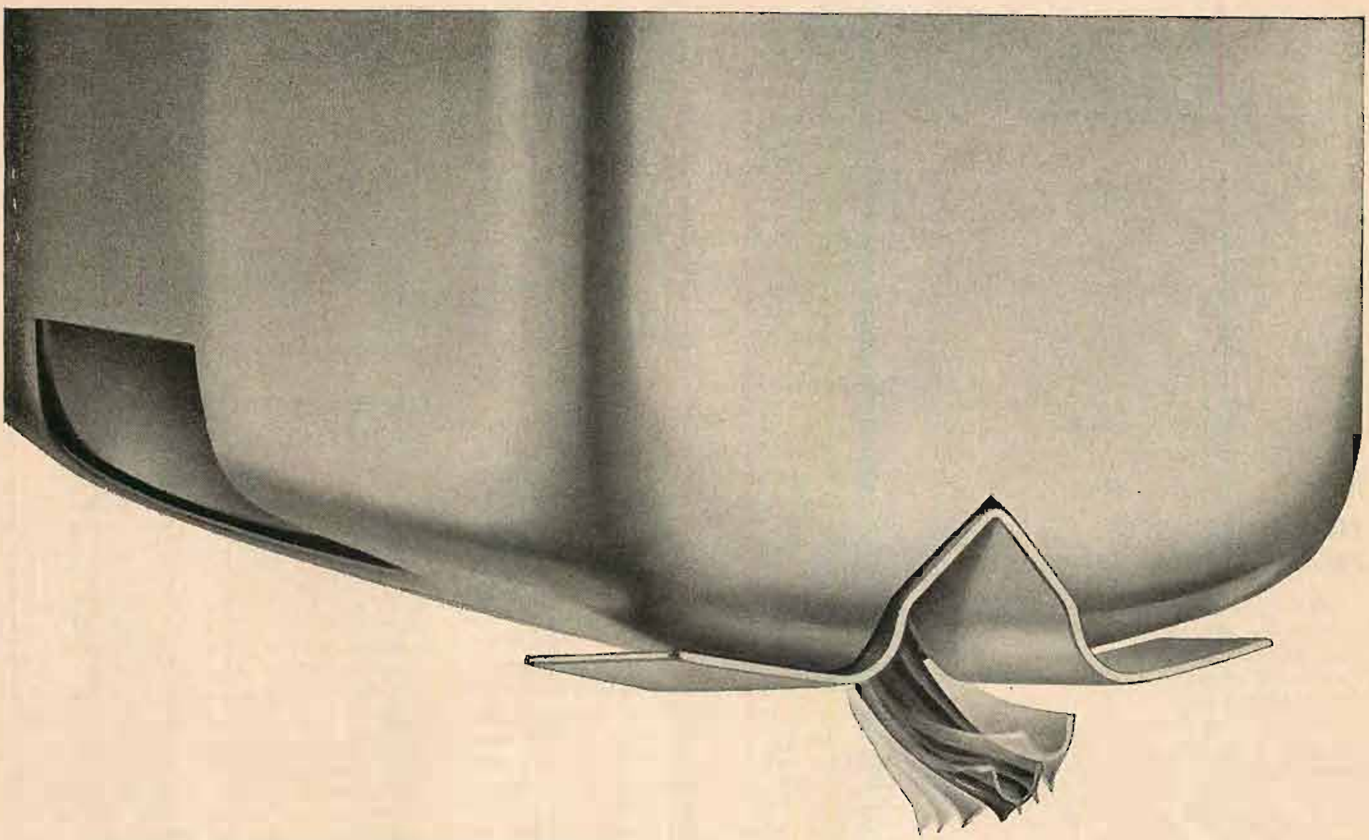


Fig. 2. Korting stereo tape recorder, Model 158S.



UP, DOWN, SIDEWAYS . . . the important difference in an Audio Dynamics' cartridge can be felt with your fingertips

Put your finger to the stylus tip of an Audio Dynamics' Stereo Cartridge. Move that tip around . . . What you feel is compliance. In Audio Dynamics' ADC-1, it is 20 x 10^{-6} cms/dyne minimum. This compliance, along with a tracking force of less than one gram and an effective stylus mass that measures less than .5 milligrams, represents a design breakthrough by Audio Dynamics' engineers. Result? Now, for the first time, by using any model ADC cartridge, the following *five essentials of true stereo reproduction* are yours:

Essential #1—Highs Free from Peaks & Distortion

Quality stereo cartridges are designed to suppress undesirable peaks and distortions in the high frequency range. These occur when the stylus mass resonates with the vinyl disc. To suppress resonance, since mass cannot be readily reduced, most cartridges are heavily damped.

Damping, however, stiffens the compliance. This creates problems: (1) High tracking forces are required to prevent mistracking and breakup. (2) The suspension becomes nonlinear, resulting in distortion.

In one remarkable stroke, Audio Dynamics' engineers lowered the effective stylus mass to just one-half milligram, eliminating forever the previous plaguing need for heavy damping. This spectacular development makes it possible for the stylus tip to resonate with the vinyl disc at a frequency so high, your ear never hears it. Response is smooth . . . the sound clean and "transparent."

Essential #2—Clean & Well-Rounded Bass Tones

With stylus mass lowered and heavy damping eliminated, high compliance and linear suspension are achieved. This results in tone arm resonance so low it is of no consequence. Only the undistorted recorded bass tones come through.

Essential #3—Record Compatibility

When a stylus is stiffened by damping, a heavy tracking force is required to prevent mistracking and breakup. This causes distortion and record wear. But high compliance and low stylus mass permit Audio Dynamics' cartridges to track at an extremely low force. Tested by Hirsch-Houck Laboratories the ADC-1 registered a tracking force of ¾ of a gram. You can forget about distortion and record wear!

Essential #4—Proper Channel Separation

With resonance removed from the audible range, nothing prevents the stylus from following the groove wall's direction of motion. Audio Dynamics' cartridges attain 30 decibels of separation in the critical 50-7000 cps range. Wandering of sound from speaker to speaker is eliminated.

Essential #5—Reduced Surface Noise

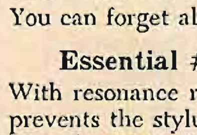
Lack of resonances results in greatly reduced surface noise.

The diamond stylus of an ADC cartridge also contributes to this virtue. It has been selected from perfect crystals, super polished and the sides oriented so only the hardest surfaces touch the grooves.

Many, many plays later, when it is necessary to change the stylus, you'll find the entire assembly comes out with a flick of your finger. No tools or special skills are required.

These five essentials for true stereo reproduction result from high compliance, low tracking force, and low stylus mass — qualities inherent in all Audio Dynamics cartridges.

Experience for yourself the performance advantages provided by Audio Dynamics ADC-1 and ADC-2 stereo cartridges! Hear them at your *dealer* today.



The ADC-1 for high quality tone arms—**$49.50.**

The ADC-2 for high quality record changers and tone arms—**$37.50.**

AUDIO DYNAMICS CORPORATION
1677 Cody Avenue, Ridgewood, New York

the controls are well placed although a little bit too stiff for our taste.

Electrically and electronically the unit provides a good level of performance also. The frequency range is 30 to 20,000 cps at 7½ ips.

To repeat, the Korting 15SS is an excellent unit for audiofans desirous of creating unusual recordings with a moderate investment.

While the machine has three heads, they are not arranged to take advantage of the usual three-head machine. A minor modification would permit the user to bring out the leads from the playback heads alone and feed them directly into the tape-head input of a preamplifier-control unit, thus making it possible to monitor off the tape as is usual in three-head machines. J-21

EICO MODEL ST96 FM-AM STEREO TUNER KIT

FM-AM tuner kits have come a long way towards the goal of "no alignment needed" that manufacturers (and builders) have desired these many years. Only too well do we remember the rather involved alignment procedures required in previous years to make an FM tuner out of a box of parts. Also we can recall that a fair amount of measuring instruments was a necessary condition to success in these pioneer days.

Well, those days are virtually gone now, and Eico for one has helped do it. The ST96 is a case in point. After the 9 hours it took us to build this unit we hooked it up to an antenna and an audio system and we began to tune in stations all over our locality. To our surprise it really worked very well. An additional surprise was in store for us when we tried to impove the alignment by means of instruments—it just wasn't necessary.

So there we are; no longer is it necessary to struggle over a hot FM. And that isn't all. In the process of eliminating the necessity for alignment they have also eliminated most of the drudgery. The use of printed circuits has replaced a high percentage of the wiring, and both the i.f. strip and "front end" are pre-assembled and aligned in the factory. In reality this kit is actually easier to put together than some of the power amplifiers we have assembled in recent months. It certainly took less time than the Eico ST40 amplifier kit we assembled some months back.

Before proceeding to describe the circuit we should point out that the ST96 contains facilities for accepting an FM-stereo adapter and because of the type of circuit, should be relatively easy to adapt. Eico has not yet announced the availability of their own adapter (at least up to press time) but it is very likely that it won't be long in coming. In any event, it will probably work well with several currently available adapters.

Circuit Description

The "front end" of the FM section consists of an ECC85 r.f. amplifier and oscillator mounted in a heavy aluminum-zinc die-casting. Following are three i.f. stages (6AU6) with two stages of progressive limiting plus the extra limiting inherent in the ratio detector (6AL5). The output of the detector feeds either the audio or the multiplex output. The audio output is supplied by a cathode follower. The antenna input is balanced.

AM signals are picked up by a ferrite-rod antenna at the rear of the chassis. It supplies the signal to the r.f. amplifier stage (6BA6) and from there through a freouency changer (6BE6) to the i.f. amplifier (6BA6). A cystal diode is used for detection. Then, after going through the 10,000-cps whistle filter it goes to the audio output stage. It also is a cathode follower.

Tape recorder outputs are provided in parallel with both the AM and FM outputs.

Tuning indicator tubes are installed on both the AM and FM tuning dials. The indicators are used as pointers to locate stations—they form an exclamation mark when the station is properly tuned.

Construction

Previously we noted how easily the ST96 goes together. Although not mentioned before a good reason for this is the clear and simple-to-follow instructional manual. We were especially impressed with the lucid pictorial views. An unusual feature is the comprehensive service and alignment instructions provided, even though they may not be needed until some years in the future.

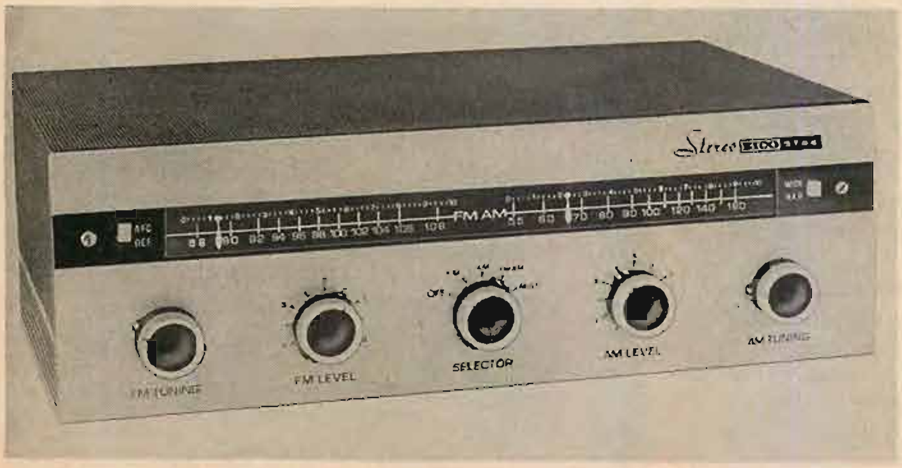


Fig. 3. Eico FM-AM stereo tuner kit, Model ST96.

Performance

The ST96 is a surprisingly good performer. We were surpised because it is a very modestly priced unit and the performance is not at all modest. The FM tuner is not the most sensitive unit available, 3.6 μv by IHFM standards, but it does pull in all the stations within our 30-mile radius, and with very little distortion. The AM sensitivity is 3 μv for 1.0 volt output at 20 db signal-to-noise ratio. We certainly would recommend this unit for those with a modest budget; you will get your money's worth. J-22

FISHER STEREO CONTROL AMPLIFIER MODEL X-1000

The X-1000 is the latest entry in a long line of integrated amplifiers by Fisher designed to complete audio control centers in a compact package. Although the newest member of the clan, the X-1000 is obviously intended to be the leader; without doubt it is the most powerful and flexible amplifier of the series.

An interesting sidelight that is revealed by this very consistent line of amplifiers is the changes that have occurred within the audio industry in the past few years. For example, the X-1000 pays extra attention to the needs of those wishing to integrate a tape deck into their stereo system. This clearly reflects the current emphasis on tape exhibited by the audiofan.

A second and especially significant reflection of current thinking is the declaration by Fisher that the X-1000 is the first of a new group of units (Studio-Standard Series) dedicated to the very highest standards of performance without restrictions as to cost. This trend deserves the heartiest plaudits from us and we offer them gladly.

The Control Center

The ideal audio control center should be able to accept audio signals from all the sources in the system and distribute them as necessary with a minimum of switching. Except for the act of placing the record on the turntable, or the tape on the deck, or tuning in a particular station, the audio control center should be in a complete charge of operating the system. The X-1000 is amply endowed to perform as a control center—with two minor reservations. The first of these is that there are only three switched convenience outlets. This is clearly inconsistent with the amount of inputs the X-1000 will accept. The second minor reservation is the rear apron location of the microphone and headphone input jacks. In consideration of the likelihood that this unit may be installed in a cabinet, those jacks become virtually inaccessible unless the microphones and headphones are installed permanently.

On the other side of the ledger, however is the obviously careful attempt to make operation as simple as possible in spite of the necessity to control 18 inputs (9 pairs), 8 outputs (2 pairs and 4 individual), 3 speaker connections, plus the usual variety of tone, volume, and stereo functions. In addition, facilities and circuitry have been included to control a

Quoted from

"ASSEMBLING A
GOOD STEREO SET"

by **Ken Winters,**
music and recordings editor
of the

Winnipeg Free Press:

> **"*I chose the AR-2a speakers over other extremely good systems because of their self-effacing dispositions. They seemed to intrude less in the music than did other speakers with more markedly individualistic sound-producing natures.*"**

A number of articles have appeared recently in which the author (or magazine staff, or consumer organization) selects components for a complete high fidelity system. Most of these systems have included Acoustic Research speakers for the same reason given by Mr. Winters: the ability of AR's to reproduce music naturally, with minimum coloration.

We will be glad to send you a reprint of Ken Winters' article, discussing his choice of components for a stereo system in the medium-price range. Other lists of preferred high fidelity equipment are also available on request: a reprint of **down beat** magazine's "Picks of the Year" in stereo components,* and a description of four stereo systems,** each selected for **Gentlemen's Quarterly** by a different audio expert as the ultimate in quality.

AR speakers are priced from $89 to $225.

AR-2*a*

**AR-2a's chosen for medium-price system, AR-3's for luxury system*

***AR-3's included in three of the four lists*

ACOUSTIC RESEARCH, INC. *24 Thorndike Street* *Cambridge 41, Massachusetts*

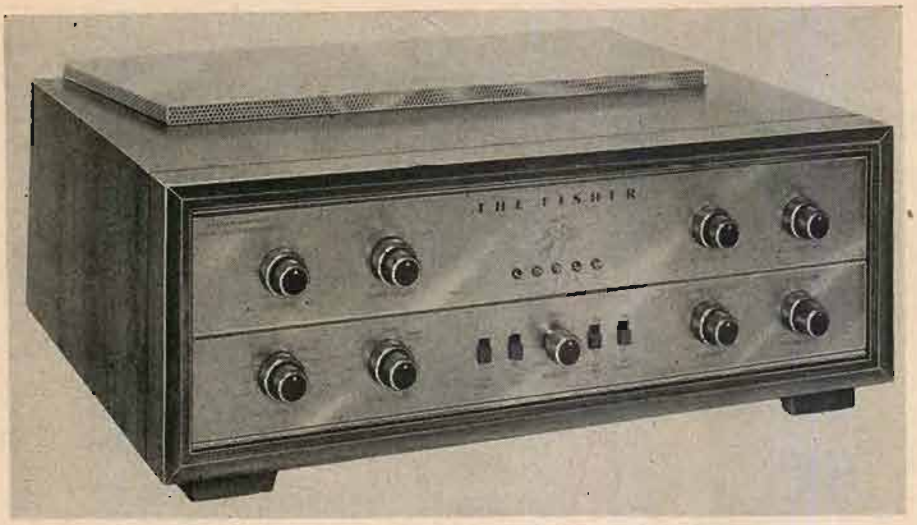


Fig. 4. Fisher stereo control amplifier, Model X-1000.

reverberation unit, to monitor tapes while they are being recorded, to balance the low-level input of a stereo magnetic cartridge, and to control a center channel. With all of these usual and special functions to control, it is indeed remarkable that there are only 9 controls (4 of them dual-concentric) and 4 switches. For those who feel that there are still too many controls and knobs for the distaff operator to master, please remember that we cannot have our cake and eat it too—additional options require additional controls. At any rater, some aid has been provided in this area—five jeweled indicator lights visually show the mode of operation.

Evaluated as a control center, adding up the positive and the negative, the X-1000 rates highly as a versatile and up-to-date unit.

The Circuit

The circuit of the X-1000 is not especially spectacular in the sense of innovation, but it is a good example of quality audio design. The word "quality" as we use it requires some explanation to distinguish it from a similarly spelled word which frequently appears in advertisements. To us quality means that a product will perform well *for a long period of time*. By this definition, an amplifier must use the best (another word that needs defining but for the moment we'll assume that you know what we mean) resistors, capacitors, switches, and so forth, and they must *not* be used at the extremes of their ratings. For example, getting back to the X-1000, the output stage utilizes a pair of EL34/6CA7's in push-pull connection. In Class AB, it is permissible to operate these tubes with plate and screen voltages some 25 per cent higher than the 400 volts used in this circuit. This would achieve a higher power output. At the same time it would increase distortion and reduce the life of the tubes. Thus, by operating the tubes conservatively the designer has assured better amplifier performance and longer tube life. Another example of this type of thinking is the use of printed circuits encapsulated in ceramic for virtually all tone and compensation networks—thus ensuring unusual ruggedness and consistency of performance.

In aggregate, the X-1000 is a quality circuit.

Performance

The performance of the Fisher X-1000 is quite excellent. Over-all frequency response is within 0.5 db from 20 to 20,000 cps. Harmonic distortion at rated output is less than 0.4 per cent; intermodulation distortion at 50 watts rms per channel is less than 0.9 per cent. Power response at rated output is 20 to 20,000 cps. Hum and noise is 70 db below 50 watts rms per channel at the low-level inputs with a reference level of 6 mv.

In addition to its excellent performance the Fisher X-1000 is designed and constructed to maintain this level of performance for a long time. J-23

ASTATIC "CANTATA" STEREO CARTRIDGE, MODEL 45D

For many years now the magnetic cartridge has ruled the roost in the land of high fidelity. So complete was the victory that some modern amplifiers do not even make provision for ceramic cartridges. With this background we were a little surprised when we heard about Astatic's new cartridge, the 45D. According to the man who made them, this little ceramic beauty will perform as well as a magnetic cartridge. In addition, it is immune to magnetic induction fields which often cause pickup hum. It struck us that if this were true, then we may be about to enter a new phase in the cartridge field.

For instance, one large advantage of the ceramic cartridge is its high output compared to the magnetic cartridge; the 45D puts out 0.2 volt whereas most magnetic cartridges would find it hard to put out 10 mv. This markedly higher output would probable make it unnecessary to have low-level stages for the phono input. Obviously this would reduce the cost of amplifiers a little, but more important it would also improve the signal-to-noise ratio.

Now, before we continue this speculation, we should report on how well the cartridge performs. Simply stated, the Astatic Model 45D is definitely in the high-fidelity category.

The frequency range from 20 to 15,000 cps is reproduced very smoothly by the 45D. There is one tiny flea in the ointment, however, there is only about 6 or 7 db of separation at 15,000 cps. On the other hand, separation increases to 26.5 db at 10,000 cps and about 35 db at 1000 cps.

In listening tests, the 45D was especially capable in the low frequencies. The over-all sound quality is quite excellent. The tests were all performed with the 45D plugged into the magnetic inputs of the amplifier using the matched networks provided.

Before summing up it should be mentioned that vertical and lateral compliance is 6.0×10^{-6} cm/dyne and that the 45D operates well with a stylus force of 1 gram. It comes with a single 0.7-mil replaceable diamond stylus and is finished with polished gold plating.

Summing up now, the Astatic Model 45D is a ceramic cartridge with definitely high-fidelity characteristics, one of the initial entries in what may turn out to be an important new trend. J-24

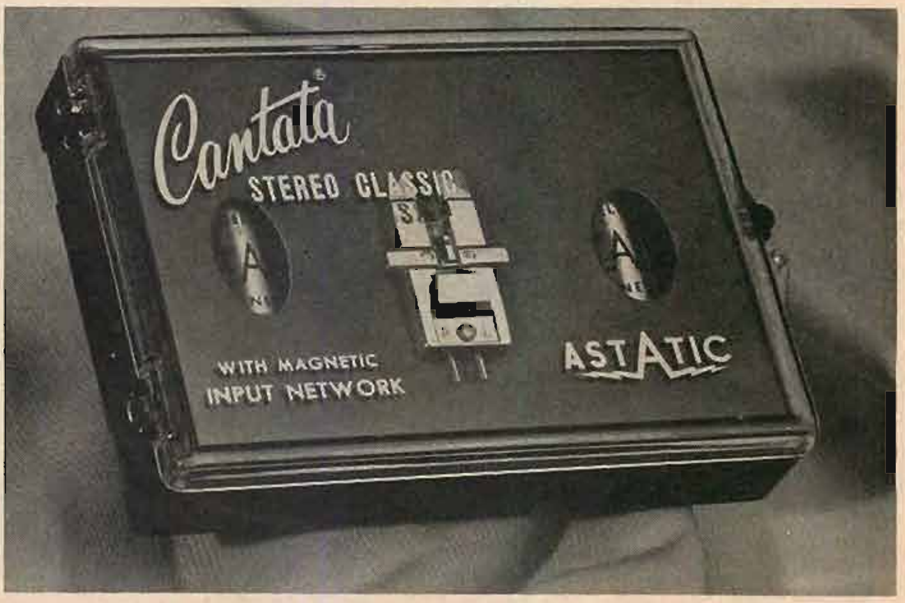
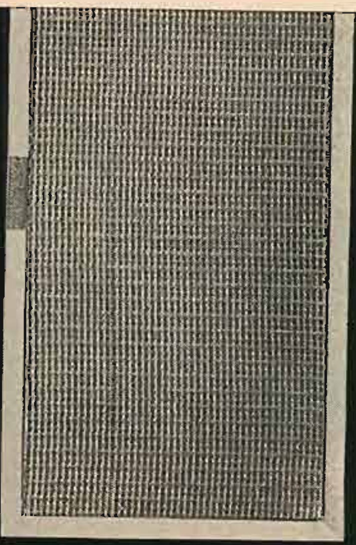
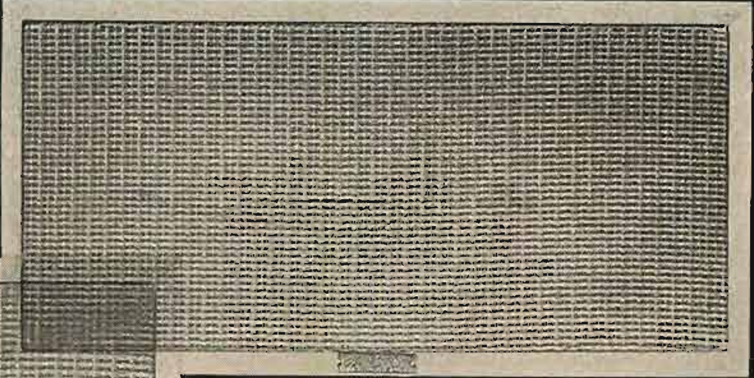


Fig. 5. Astatic "Cantata" stereo cartridge, Model 45D.



THE A. E. S. *Gigolo*

ONE OF THE MOST SOUGHT AFTER PRODUCTS IN THE HIGH FIDELITY INDUSTRY



At our present rate of sales and production, A. E. S. will sell nearly 100,000 Gigolos this year.

Imagine, now you can own a speaker with this quality for only $15.00.

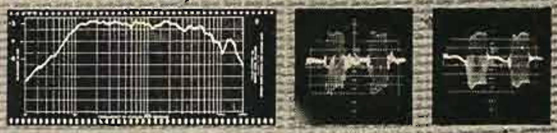
TRY IT — WE GUARANTEE IT
100,000 PEOPLE CANNOT BE WRONG

DESCRIPTION:

The Gigolo is constructed with a resonant resistant all wood product of at least ¾″ thickness throughout. Its outside dimensions are 24″ long, 12″ high, 9½″ deep. The heavy construction and the fine workmanship suggest a value far exceeding its low. low price. All units sold on 100% MONEY BACK GUARANTEE.

Price $15.00. Unfinished only.
F.O.B. Factory

SPECIFICATIONS:

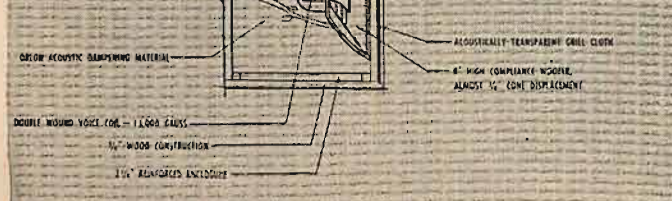


Frequency response 500 Tone bursts 3500

Maximum frequency response	19-21000 cps
Frequency response ±8 db	45-18000 cps
Harmonic distortion	less than 3% 70-21 kc
Impedance curve	within −0 +200% of 8 ohms 20-20000 cps
Flux density	11000+ gauss

Frequency response curve run at continuous 10 watts.

Power handling capacity, the Gigolo may be used with small economy amplifiers of very low wattage, as well as with the highest power component amplifier with satisfactory results.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TERMINAL STRIP TO AMPLIFIER
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ACOUSTICALLY-TRANSPARENT GRILL CLOTH
8″ HIGH COMPLIANCE WOOFER, ALMOST ½″ CONE DISPLACEMENT

A.E.S., Inc.
3338 Payne Avenue, Cleveland, Ohio

Gentlemen please ship__________GIGOLOS.

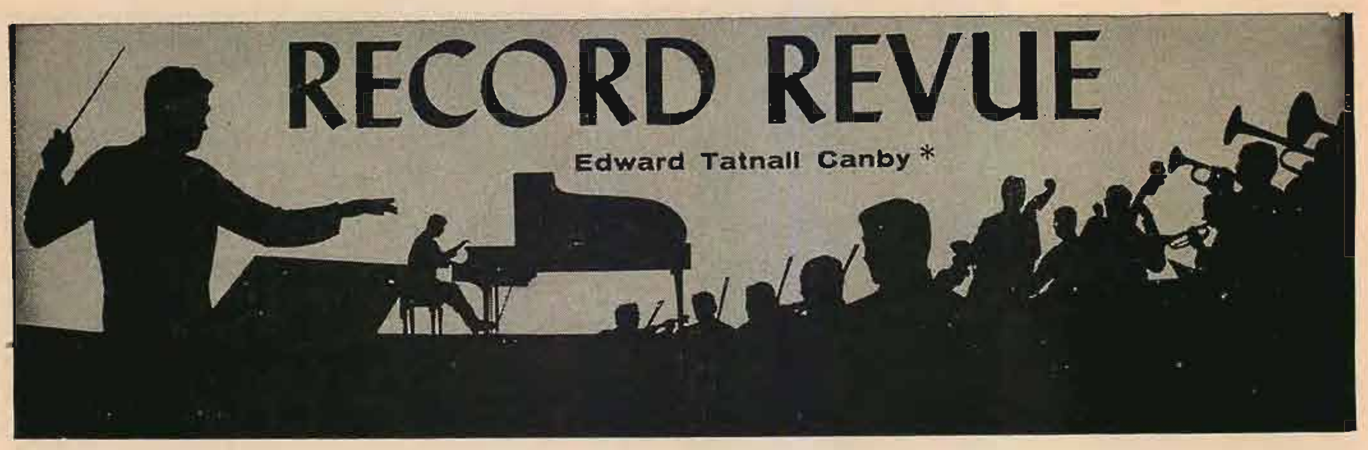
I understand these units are guaranteed and if I am not satisfied I may return for a full refund of sales price, $15.00 each.

Name____________________

Address____________________

City and State____________________

Enclosed find check__________money order__________



RECORD REVUE

Edward Tatnall Canby *

FROM SWEDEN TO ITALY

Blomdahl: Aniara—An Epic of Space Flight in 2038 A.D. Royal Opera, Stockholm, Vienna Volksoper Chorus and Orch., Janssen.

Columbia M2S 902 stereo
(mono: M2L 405)

Odd—here's a space-opera, modern as the next century, dissonant as all get-out and full of space-age sound effects; but I find it, even so, of a relatively old fashioned flavor. Relatively, of course. The musical idiom seems to me to date itself roughly in the 1920 period, though the opera was premiered in 1959, brand new; the general atmosphere and impact of the music is, however, of an earlier sort, for it is big, full-blown, ultra-serious, a "satire" on life in the late-Romantic vein of, say, Berg's "Wozzeck." That would be anywhere from perhaps 1905 to 1925. But the overtones are Wagnerian, the opera mechanisms, solos, big chorus, big orchestra, complicated stage-doings, going back even further. Nope, this is *not* a modern chamber opera nor is it streamlined in the slightest. I guess for Swedish space travel streamlining isn't a musical requisite.

Nevertheless, if you are tuned to big and rather heavyweight enterprises on records you'll find some considerable impressiveness here. An expert orchestra, from pseudo-tapesichordish sounds to sardonic heavy jazz, a big, wobbly (Viennese) chorus that sings the massive laments of the lost space-refugees with much expression, if not very much comprehensibility (it's hard enough to get the pitch-sense of such a group when they sing Brahms or Bach!), a narrator, assorted solos with names like Daisi-Doody, La Garçonne, Chief Technicians I, II, III (an old opera convention, those Roman-numeral second-liners). The Mimarobe, the Blind Poetess—all this plus sounds of space, courtesy the Swedish Radio, is yours for the listening.

To tell the truth, I haven't reached the end myself yet, but press-time beckons. I've followed (mentally) the space-ship Aniara, with thousands aboard bound for refuge in Mars, to the point where something goes wrong and the darned thing veers off on a course straight out into nowhere. That's the plot-line. What happens when you are all set for nowhere? That's us, symbolically, of course.

Dissonance, yes: but this opera is far less modern, more operatically conventional, than, say, the more arresting music of Orff, even though Orff uses plain old-fashioned chords and runs his keys practically into the ground, he is so very un-atonal. It takes more than dissonance to make a modern opera, more than space ships. I call this a real old-fashioned heavyweight opus, dressed up in an interesting semi-modern musical guise. I guess the Swedes do better at streamlining furniture than music.

Buxom and Handsome

Chaucer: The Wife of Bath (Canterbury Tales). Read by Dame Peggy Ashcroft.

Caedmon TC 1102

Here's a good illustration of the values in spoken English, as compared with its traditional literary and poetic form, the printed word on paper. Yes, a good many of us have dabbled a bit in this early English classic, written in a language that is only barely comprehensible to us moderns, unless "translated." We probably had to read it in high school English class, at a stage when the subtleties were mostly over our silly heads. Yes, the complete text, in the original and in good and readable translations, is easily available to anyone who wants to bother.

But who does? In practice, only those who are professionally in some branch of literature or poetry ever touch Chaucer after school hours. Yet on records the situation suddenly is different. Anybody can listen: more important, a lot of people *will* listen, who with the best will in the world somehow are never going to get around to Chaucer in printed form. And once you listen, of course, you find out what good things were there all along—even if it is only in part: for this is merely a "short" excerpt from the whole work, one episode out of many.

In Chaucer's pilgrimage to Canterbury one after another of the traveling companions entertains the rest with a personal life history and a few good stories to help it out. The wife of Bath, one of these, was a buxom and handsome woman who of "Housbondes atte chirche dore hadde sche fyfe"—she had run through all five of them and was out for more, nor did she mind saying so in a good humored way. She wore bright red hose and fancy headgear, cut a striking figure, five husbands or no, and her frank and warm story of how it all happened is spiced by some pleasantly friendly observations on how a woman gets exactly what she wants in this man's world. Quite a gal! And Dame Peggy Ashcroft on this record doesn't restrain herself a bit, not even for the down-to-earth parts, which Caedmon has had the very good sense to leave unedited in the modern translation of J. U. Nicholson.

Better a small sample of Chaucer, suitably animated and dramatic, than none at all. I could take a lot more of this myself.

Wagner for Band (Excerpts from "Lohengrin," "Das Reingold," "Parsifal"). Eastman Wind Ensemble, Fennell.

Mercury SR90276 stereo

The fancier the music, the better this highly professional band plays and the warmer is its emotional temperature. I thought some of its earlier and lighter recordings were pretty chilly, if highly accurate—this Wagner, arranged traditionally for concert band, is full of high-power emoting and smooth-as-silk harmony.

Wagner, of course, based his music upon the usual string foundation, more than a half-hundred players in his normal orchestra. But he used the winds heavily, in band form and for all sorts of solos and solo passages; it was his munificent innovation to have at least four of each kind of wind instrument, counting close relatives, so he could write complete harmony in any tone color. That makes a lot of brass and woodwind.

Here, the string foundation is removed, the swirling violins replaced by skirling clarinets. As always—though these play with an amazingly string-like ensemble—there is a certain forced quality about the sound. Strings, remember, do not have to take breaths and can play long, sustained or continuous passages without turning red and gasping for air. No matter how smooth and expert the concert band, somehow there is for my ear always a residue of this incompatibility, a kind of tootling hysteria among the clarinets and flutes that sometimes sounds plain funny—especially when the band is lousy and the players out of tune. Nothing like that here!

These standard arrangements, the familiar Prelude to Act III and Bridal Chorus from "Lohengrin," plus Elsa's procession to the cathedral, the Overture to "Rienzi," the Good Friday Music from "Parsifal," are well filled out in sound and, indeed, include strings as well as cymbals and the like—you'll notice the sounds of double bass and harp. They count as band, I guess, because they are just plain needed. The big, brassy parts are magnificent on this record, the more lyric, sustained swelling-and-dying music is played with astonishing smoothness and flexibility—but the original still sounds better.

Stravinsky: L'Histoire du Soldat (Story of a Soldier). Melvyn Douglas narr., James Mitchell, soldier, Alvin Epstein, The Devil; Members of Kapp Sonfinetta, Vardi.

Kapp KDC 6004-S stereo

This is the only extant recording of the complete Stravinsky work with the story-line included, earlier versions in English and in the original French having departed the catalogue. (I think they were from Vox.) The more common version is merely an instrumental suite from the musical score. Much as I like the suite, I find this complete version (minus the visual part, of course) more interesting. By itself, the music emphasizes its early neo-classical origin, a sort of pre-nineteen-twenties snazziness. Good.

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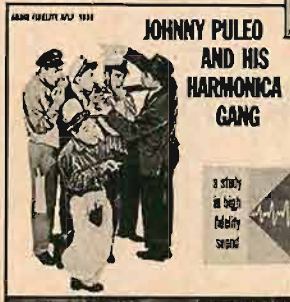
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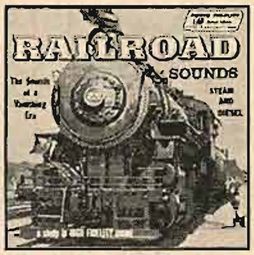

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But with the story to go along, it shows its easy adaptability to dramatic action, as is so often the case with Stravinsky's works, whether ballet, stage pantomime, oratorio, or what-not.

The English translation of the semi-doggerel French, slangy and folksy, tends to run to a false kind of simple-mindedness, too arty. This version is not much different than others. Professional acting voices somehow never can sound simple-minded without being offensively patronizing. The Soldier here speaks that way, the Devil is too wheedling, the narrator tries too hard to avoid the rhyming sing-song and only succeeds in making it more noticeable. But, these actor-style affectations aside, the show is still a very good one and convincing. The forlorn little discharged soldier has his bouts with the Devil in disguise, rescues his princess, loses her and everything else for a typical modern ending in utter futility, to a tale that combines familiar elements out of "Rip Van Winkle," "Orpheus," and a passel of Grimm's Fairy Tales. And the Stravinsky music, interlude and incidental-style, fits in perfectly. A good evening's entertainment.

Berlioz: Symphonie Fantastique. Vienna State Opera Orch., Golschmann.

Vanguard demo SRV 120 stereo

Vladimir Golschmann is a turn-of-the-century Russian who managed to stay that way through 25 years of stately isolation conducting the St. Louis Symphony. Now he's a sort of free-lance turn-of-the-century Russian; but Vanguard continues, unwisely I say, to use him for other sorts of music. Say, this Berlioz. The contrast in habitual viewpoints between the Viennese players and Golschmann's slightly un-Viennese background only complicates matters.

The excellently hi fi results here (and at a bargain price) are technically very fine as to the playing. No flubs. No ineptitudes. But this is ultra-Romantic French music—which means that it must be (a) violently electric and (b) highly personal. This performance is (a) straightforward, medium-voltage and (b) utterly impersonal, briskly whisking through page after page of theoretical triple-exclamation marks (speaking orchestrally) as though the whole thing were one of those bright Italian overtures for light listening. It isn't. It has magical effects. It must sigh and weep and flash incredible sparks.

An expertly routine performance, missing about two thirds of the sense of the music.

Rossini Overtures — William Tell and the Famous Five. Philharmonia Orch. Von Karajan.

Angel S35890 stereo

The most compelling feature of these famous Rossini overtures, aside from the expertness of their construction, is a kind of flashing-eyed passion, not serious yet intense, which is, of course, highly Italian. It isn't an easy effect to pull off in any sphere of life by a non-Italian—either it strikes false, or it is over-profound and labored.

Von Karajan wouldn't seem a likely man for Italian eye-flashing, but he and the very British Philharmonia pull it off together in wonderful style. There's just the right sudden terror, just the needed crisp attack, the requisite piercing rays of sunlight through the clouds, here and there, to make these very familiar works seem both important and dramatic, yet not a bit overdone. The Italians always have been able to make a tremendously convincing fuss over nothing very much. Everybody loves them for it.

THE VIENNESE TOUCH

Beethoven: Mass in C Major, Op. 86. Akademie Kammerchor, Vienna Symphony, Moralt.

Vox 720 DL

This is a typically Viennese sort of Beethoven—I sang in a New York performance of this work a few months ago under the Swiss-American conductor, Paul Boepple, and am amazed at how legitimately different the two performances were, both with excellent music listening values.

What is Viennese? Well, for one thing the Viennese choirs tend to be made up of heavy, wobbly voices that blend indifferently but promote a rich, strudelish tone, much milder and more sincere than the hard professional wobbles of our equivalent American groups. For another, the Viennese still prefer slow speed when they can manage it (i.e. under one of their own conductors), whereas most of the rest of musical performance has got faster and faster. The combination of slowness and richness is bound to hit an outsider at first as a species of stodgy conservatism. But, more often than you'd think, after a period of adjustment you will begin to realize that the Viennese music-making is good and very much alive in its own peculiar way. Not stodgy at all.

So it is with this Beethoven Mass. For the first few minutes you will want to turn the whole thing off and trade the record for a livelier one—the wobbles are so heavy you can scarcely make sense of the tunes, the speed is uncompromisingly slow and plodding. Yet hang on for half the first side and you'll begin to feel musical sincerity and plasticity. I did, anyhow. I liked this Beethoven.

The recording is very so-so, evidently taken at a performance. The engineers at Vox have (as far as I am concerned) done the inexcusable—cut the background "room sound" in and out with a switch at the exact instant a section begins or ends. They could so easily have faded it gently up or down (you can use a length of background-sound tape from some other part of the performance recording) for a musically far less obtrusive effect.

Mozart: Requiem in D Minor, K. 626. Soloists, Vienna Hofmusikkapelle, Krips.

Richmond B 19077

If you can get it, here's another excellent Viennese performance that may at the beginning seem typically wobbly and stodgy, but which grows no end in stature as you play through it. This is a "strict" performance—with an all-male church choir and male solos, boy altos and sopranos. The

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sound of the boys, like the familiar sound the Vienna Singing Boys of touring fame, is rich and sweet, not thin and piping (lovely, too) as in English boy choirs. The solo parts for soprano and alto are also boy soloists—excellent. Under the well known Josef Krips this is a persuasive and moving performance in spite of the Viennese turgidity of sound.

Beethoven: Serenade, Op. 8.
Kodaly: Duo for Violin and Cello. Heifetz, Primrose, Piatigorsky.
RCA Victor LSC 2550 stereo

RCA has done it again—the company is well known for doing some things again and again. Most of us will remember the big-name trio of earlier RCA history that was indelicately named the "million-dollar trio" by persons unofficial and anonymous. Here is the million dollars once again, though the earlier cellist, Feuermann, is long since dead and the other trio, if I'm right, wasn't even the same instruments. In both cases, RCA pulled out its biggest names and set them to work on "chamber music" that, according to the figures, wouldn't sell worth beans on its own hook; but give it the big-name performance and we'd eat it up.

We did, and we will again, on this disc and another to go with it. I thoroughly enjoyed both sides here, though I found them ill-matched musically—it's a big wrench from Beethoven to Kodaly—and ill-cast as far as Beethoven is concerned though very well cast for Kodaly.

Beethoven's early and once very popular little trio is given the slavic treatment (by two of these three, anyhow) and it comes off unctuously alive, if not exactly with a Viennese sound. Anybody can tell in a moment that Heifetz is no habitual chamber music player—the big soloistic technique comes barging through all over the place. Piatigorsky is a smoother actor; his cello sounds most of the time like a cello should—in chamber music. Primrose does the inevitable tenor-voiced fill-job that is the lot of all violists, slavic or otherwise.

Kodaly comes out stylistically a lot better. In music, at least, the Hungarian impetuosity is in perfect accord with the Heifetz-Piatigorsky sort of showmanship. And Kodaly wrote his very best music for such small ensembles, in spite of the popularity of "Hary Janos" and the like. I found this Duo for the violin and cello a first-rate piece of original string writing, and the playing here seems to me to bring out its very best, in particular the Hungarian folksiness of the last movement.

Beethoven: Trio in D, Op. 9 No. 2.
Bach: Three Sinfonias (Inventions).
Schubert: Trio No. 2 in B Flat. Heifetz, Primrose, Piatigorsky.
RCA Victor LSC 2563 stereo

Here's the second of the pair of "million dollar trio" recordings; it is more of a piece than the first. The short Bach works are three of the Three-part Inventions, originally written as keyboard exercises (harpsichord or clavichord), here simply played each voice to an instrument. Since the original intention was to illustrate the writing of intertwining "voices" on a single keyboard, the three players make clear in a literal way what was implied in the Bach writing. Sounds quite OK—Bach can take a lot more "arranging" than this.

The Schubert is a little-known early trio, rather nicely suited to these players, in that the style is early-Schubert Napoleonic (it goes with the Grecian ladies and their high waists, long, flowing gowns à la Jane Austen). —In musical terms, this means essentially a kind of fruity Mozart-Hadyn style, gone dead ripe and sweet. Heifetz and Piatigorsky make the most of *that,* and so does Primrose on his viola.

As for this Beethoven, it is meatier than the Serenade, Op. 8 on the other record of the pair and so makes these players work harder, using more of their plenteous musical intelligence. Sounds good, if still somewhat slavic.

Beethoven: Symphony No. 6; 12 Contra Dances. Berlin Philharmonic, Lorin Maazel.
Deutsche Grammophon
SLPM 138642 stereo

Lorin Maazel, born in Paris in 1930, is one of the finest of the young "German" conductors, one of those paradoxical personalities who seem instinctively to understand a particular area in music as though born in its midst. This is an excellent "Sixth," avoiding deftly and with the most casual ease that studied, stilted "nature painting" that many older conductors, even the greatest, feel they must somehow force out of the music for better or worse. The harder you work at Beethoven's simple pastoral scenes, the peasant dances, the birds, the ominous thunder rolls and the bursting storm, the more dated and foolish it all sounds. Maazel (with the Berlin Philharmonic to help) just plays the music well as music—and lo, the tone painting is as honest and sincere and effective as it ever could have been in Beethoven's own day. Only a rather high-tension thunderstorm, with a distinctly modern voltage to it, gives the youthfulness of this performance away.

Stereophonically, we have here the now-traditional big, distant DG symphonic pickup (probably M-S or cross-mike technique, equivalent of the old mono single-mike pickup). It's good for Beethoven.

Beethoven: Symphony No. 5; King Stephen Overture. Philharmonia Orchestra, Klemperer.
Angel S 35843 stereo

This continues the great stereo series of Beethoven symphonies with this elder-statesman of German music, borrowed by the British to lead their finest orchestra. After dozens and dozens of "Fifths," this one is really quite extraordinary for its straight-

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forwardness, unselfconscious and unhysterical, combining the virtues of an older way of doing Beethoven with a somewhat tempered modern literalness of tempo that would mark the performance as mid-Twentieth century immediately, even if the conductor weren't in his mid-seventies.

The "Fifth" is so enormously celebrated that it has for long served as a sort of musical flagpost for current thinking in the large way; its curiously unspecific tempos, pauses, dramatic rhythm-changes, allow for an unusual latitude in interpretation. Thus in the "Fate knocking at the door" days of the early part of this century and before, the symphony was heavy, deliberate, the opening idea often pompous, played extremely slowly. Then came "V-for-Victory" and mounting tension in the world, accurately reflected in more recent playings where the opening sounds suspiciously like Fate operating a machine gun, to blast through the darned door, once and for all! The rest of the symphony has in late years taken on a correspondingly hysterical, machine-like quality, to the point where much beautiful detail is simply lost in the speed-up process.

Try Klemperer as an antidote to all that. He keeps things going steadily—no old-fashioned ritards, no heavy drama. But the tension and the speed are back where they ought to be for the music's sense and the musical impact is that much the greater.

Berg: Lyric Suite.
Webern: Five Pieces, Opus 5; Six Bagatelles, Op. 9. Juilliard String Quartet.

RCA Victor LSC 2531 stereo

RCA's cautious approach to modernism mainly appears through the polished and competent playing of this string quartet, a group that is admittedly one of the best in technical prowess as far as Twentieth century music is concerned though its predominant expression is, shall I say, a kind of cool fire. OK, nevertheless, and let us be thankful that a big company can occasionally turn itself in the direction of such famous musical landmarks as these.

Unlistenable? Not any more, even for most of us who have no "trained" ears. The ears of all of us, remember, reflect our times inevitably and progress in their ability to "hear" just as surely as time itself moves along. Thus, the Lyric Suite, one of Berg's late works (completed 1926), is now clearly of that very Romantic tail-end Viennese school that sounds to us strangely sweet and nostalgic, in spite of plenty of dissonance.

What is dissonance? It all depends on how it is written, after all. Singing commercials are full of it. More important is that this is a string quartet in a violent, intense, often tragic late-Romantic idiom, already semi-12-tone, yet retaining for us the dark remains of Viennese elegance ever so clearly, dissonance or no.

The notes don't tell you, on the record jacket, but you'll be intrigued by the famous scherzo movement in this work, where the high-speed strings, squeaking and scraping, sounding like so many eloquent mice, play their breathless little piece frontwards, then after a trio of violently dissonant massiveness, play the thing again backwards, straight to the beginning. (The "on-the-bridge" nasal wire-tones and the frequent violent tremulos are typical of the Viennese school——you always hear them.)

People generally fall into either of two preference-categories in respect to the Viennese non-identical twins, Berg and Webern, first-generation followers of old Schoenberg. Either Berg hits you, or Webern does. I'm a Berg man, myself. Webern writes enormously intense miniatures, some only a few seconds long, a batch of them played here. You may, or you may not, gear yourself to these highly boiled-down collections of squeaks and scrapes (as they sound on first hearing). Worth a try —it doesn't take very long. They are generally acknowledged masterpieces—of their *genre*.

Mozart: Piano Concertos No. 20 in D Minor, K. 466; No. 23 in A, K. 488. Eric Heidsieck; Paris Conservatory Orch., Andre Vanderboot.

Capitol SG7240 stereo

Now here's a real Mozart pianist—though he is only 25. Quite remarkably *sympathique* as the French would say; he *is* French in spite of his odd name, the scion of one of the famous Champagne families; he was brought up a bit like Mendelssohn, in cultured and well-to-do surroundings, but he's not a bit less competent for all that.

True, the fellow can rise still higher. But even so, this is one of those casual-appearing Mozart discs that strike the practiced Mozart listener within moments as *right*, where so many performances, with so many of the great names as well as the small, strike the same ears as merely routine, or monotonous, or downright ugly. This pianist has *it*, the native sense of the grace and poetic dignity of the Mozart style. The music glows with him. It sounds musical all the way through, it is properly dramatic, easily so, but never overpressed, for garishness. This is the way—the only way—to make Mozart into living music.

The Paris Conservatory is its usual contradictory self, combining a sense of haphazard sight-reading (as always, in the strings) with flashes of brilliant orchestral expression (as always, in the winds). We can assume that the conductor with the funny name is also French, like the pianist.

Nice, distant European stereo.

Schubert: Piano Sonata in D, Opus 53. Emil Gilels.

RCA Victor LSC 2493 stereo

One of the oddest things about the great Russian performing artists, who have emerged in these last years from their isolation inside Russia, is the curious sense of separation between their traditions and ours-in-the-large.

They play the same music (at least, they

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play the same older music). They have, right along. But thanks to the peculiarities of the iron curtain and its equivalent in the prewar years, these artists have perforce grown up on their own inner Russian product. Just as, inevitably, a group of people isolated from a mother tongue will in not many years develop a dialect, so a complex of musicians, even one as large as that of greater Russia, will develop its own subtle differences of musical expression over the years, when the continuous contact is interrupted that alone can keep music under *one* broad interpretative roof.

So it is here. The Gilels Schubert is far from *bad,* nor is it in the slightest degree routine, inept, uninteresting or otherwise on a less than very high plane. Yet throughout, for those who have come to know Schubert's difficult and fascinating later piano music, there are oddly "foreign" touches, new ways of thinking, new dramatics, and lacks of drama—impossible to go into detail, but the cumulative effect is really quite strange. The only possible answer is that this is the result of learning Schubert from the printed notes, rather than, as it the case more regularly than we like to admit, learning the music through *hearing* it, with the notes as a factual reminder.

Generally speaking, I suggest that Gilels plays Schubert with bravado, in an outward, rather impersonal way, with a typically slavic sense of drama as contrasted to the highly intimate and personal feeling that is normally associated with Schubert in the Western (and home) tradition. Gilels manages an admirable unity, and more sense of shape and continuity than most pianists can achieve out of this very rambling and long-breathed musical span. But it is achieved by forceful means, through rhythm, through strength, rather than out of those inscrutably profound inner contrasts of incredible harmony and melody that—for most of us who live in the musical West—is the essence of Schubert. I liked Gilels, but I was bothered, too.

SOLO

Ruggiero Ricci Solo Recital (Stravinsky, Hindemith, Bartok, Prokofiev). Violin unaccompanied.

London CS 6193 stereo

This fine recording climaxes—and I mean just that—a considerable series of Ricci records which, alas, have been on my waiting list on and off for several years without yet finding a place in these columns. As good a time as any to refer you back, then, to his concerto recordings and showpiece specials, equally fine in their various ways, ranging from the Sibelius, Tchaikowsky, Prokofiev (as London spells it) concerti to the showy solo Paganini Caprices. He has a superb finger and bow technique but, more important for you and me, his ear and his sense of pitch are uncanny, his feeling for harmony unerringly right—so that you will always know exactly what the *sense* of the music is, without having to "infer" it. (Many a good violinist takes a traditional licence with pitch accuracy as part of an accepted violin style of playing.)

This climax to Ricci's work constitutes a whole concert program on one disc, five pieces for violin alone, without accompaniment, all of them recent works. Nobody playing today could be a better bet to make the often very extensive musical sense and meaning in these works plain to the listening ear.

If you have the nerve to try, you'll find that this is exactly what happens. From the light, tuneful and humorous Prokofiev sonata —in the "Peter and the Wolf" mood—to the major late Bartok sonata, one of his really big works in spite of the medium, Ricci makes musical sense to the point where (with London's big, *resonant* fiddle sound) you can quite well forget the "lack" of an accompaniment. It is no lack, of course; for the entire intended meaning is conveyed by the violin on its own. No accompaniment is needed.

Segovia—Three Centuries of the Guitar.

Decca DL 710034 stereo

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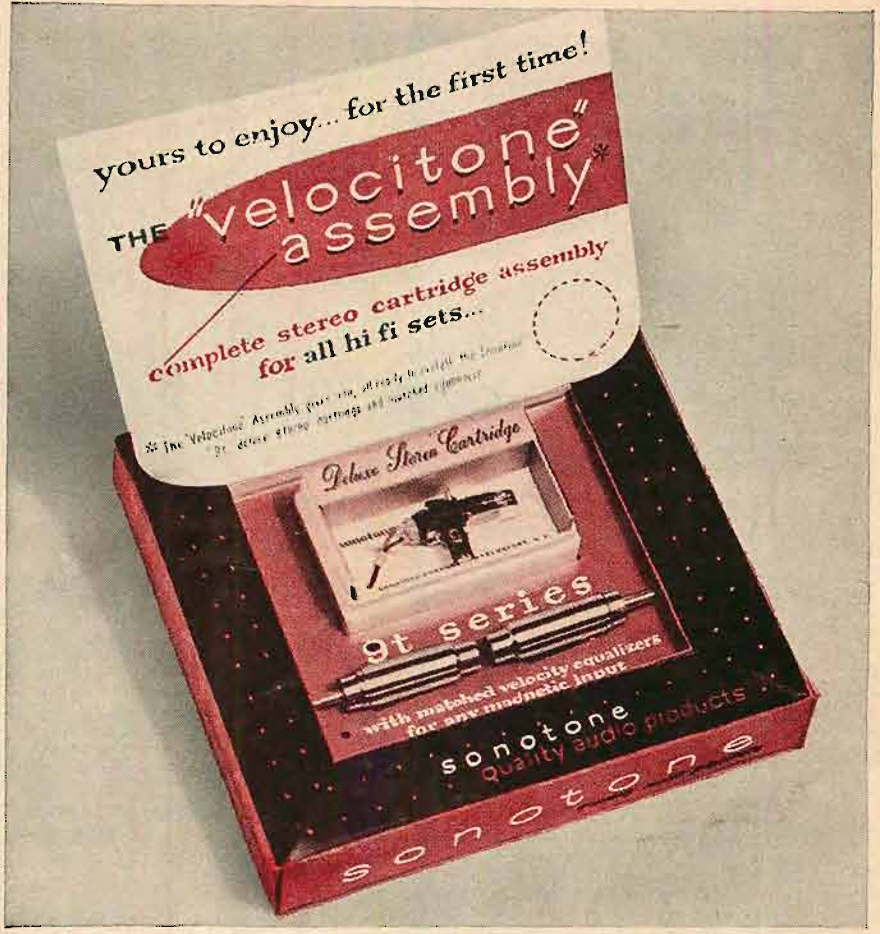
(*Continued on page 90*)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JAZZ and all that

CHARLES A. ROBERTSON*

STEREOPHONIC

J. J. Johnson: J. J. Inc.
Columbia CS8406

After a long career as the leading modern trombonest, J. J. Johnson is devoting more and more of his time to arranging and composing. Quite a few of his followers are just getting used to the idea that less of his time will be spent in clubs or on the road. This recording of the sextet Johnson headed most recently brings the fact home quite forcibly, as anyone who woud disband such a well-knit group must have other business to attend. The half-dozen Johnson originals had been in the repertoire for eight months before the sextet went into the studios last August, and the leader claims to have recorded with rehearsal time of equal adequacy only once before. He considers the conditions ideal this time, and everyone makes the best of the opportunity. Johnson's reluctance to join Miles Davis becomes more understandable on hearing this group in excellent stereo. It comes close to the peak Davis reached when his quintet recorded twenty-four numbers for Prestige at one stretch.

Freddie Hubbard, trumpet, and Cliff Jordan, tenor sax, are inspired into what is commonly described as playing over one's head, and the rhythm section of Al Heath, Cedar Walton and Art Harper is fully up to Johnson's needs. The trombonest's solos are among his finest, and his writing is varied and interesting enough to make an impact for a considerable period.

Bill Evans: Explorations
Riverside RLP9351

While Horace Silver rations his followers to an album twice yearly, the admirers of Bill Evans consider themselves lucky if less than a year passes before they are privileged to hear another of his trio recordings. Both pianists could step up production without losing any of their audience, but they are severely self-critical and maintain some of the highest musical standards to be found anywhere. So far, neither has yielded to various blandishments and consented to do an album of ballads or show tunes with a string background. Should that day ever arrive, serious jazz devotees might forgive such an indiscretion more readily than they do the lapses of lesser lights now. When it comes to transforming songs of ephemeral emotion into an enduring personal statement, these two can do no wrong. Evans, who likes themes to rest on the shelf awhile, selects five from a dusty pile for his current offering, carefully untying the faded ribbons on *Sweet And Lovely, Haunted Heart, I Wish I Knew, Beautiful Love,* and *How Deep Is The Ocean?*

As Evans reads each tender epistle, he wears the composer's heart on his sleeve rather than a performer's brittle display of cunning. No lace trimmings are needed, and listeners who usually take sentiment with strings attached should be content to hear the real thing for a change. Bassist Scott LaFaro and drummer Paul Motian, both regular members of the trio for more than a year, lend sensitive support, as does the finely wrought stereo setting by Bill Stoddard of Bell Sound. Added inducements are the inclusion of John Carisi's *Israel*, and a magnificent LaFaro solo on Miles Davis *Nardis*.

Keith Textor: Sounds Terrific!
RCA Victor LSA2365

Paul Smith: Carnival! In Percussion
Verve V64051

Every stereo spectacular must have a gimmick, but merely shifting a set of bongos from channel to channel is no longer enough. Some of the electronic tricks on these albums are quite ingenious. Keith Textor, a Fred Waring alumnus who now devises television commercials, thought of dramatizing a dozen songs for the "Stereo Action" series. With the aid of sound effects and the usual percussion, he makes realistic sketches of such tunes as *Lullaby Of Broadway, A Foggy Day,* and *Hey, Look Me Over.* The particular bit of business that is out of the ordinary involves a chorus of four boys facing four girls, with engineer Bob Simpson recording each group on a separate channel. But by the time Dick Gardner is finished with the remastering, the individual voices are heard from any point on the stage or all together, depending upon the requirements of the script. The little playlets are imaginative and will hold the attention a lot longer than do most such productions.

Paul Smith takes charge of Verve's first venture into the percussion field, and his treatment of the Bob Merrill score is bound to win with many plaudits. Known in jazz circles for his association with the Johnny Richards orchestra, Smith plays piano, organ, celeste, harpsichord, and the keyboard glockenspiel. One recent percussion release, not from either of these labels, made the disastrous mistake of building the sound of a harpsichord to heroic proportions and feeding it through an echo chamber. Smith wisely aims for an exact opposite effect and maintains a level appropriate to the keyboard instruments throughout. Any or all can be heard at once from various points through the agencies of multi-taping, and the resulting stereo impression is often that of a raw of music boxes designed to contribute different tonal qualities to the same tune. Included is a reading of *Magic, Magic,* which was omitted from the "Carnival!" original cast LP.

The Charles Bell Contemporary Jazz Quartet
Columbia CS8382

As an undergraduate at the Carnegie Institute of Technology, Charles Bell formed the Contemporary Jazz Quartet in 1958, and it worked around Pittsburgh before going to Georgetown University last year to take top honors at the Intercollegiate Jazz Festival. A Birdland engagement followed, and now the group makes its recording debut under the auspices of John Hammond, who also sat on the jury which passed out the awards. Bell has whitten chamber works and string quartets, studied under Nicholai Lopatnikoff, and firmly espouses the fusion of jazz and classical forms. Although seven of Bell's originals make up this set, he remembers that fusion begins at home and allots an equal say in the proceedings to each of his fellow workers. The unit operates with a fine balance and is already one of the best integrated to be found anywhere in jazz. Especially striking in stereo is the frequent interplay between Bill Smith's guitar and the leader's piano. Drummer Allen Blairman has developed a unique style that always fits in, and bassist Frank Traficante untangles the most complex rhythms.

Despite Bell's classical leanings, the quartet establishes itself first and foremost as a part of jazz and has the resiliency to absorb any weighty ideas. In turn, Bell always writes within the capacities and character of the quartet. Together they succeed in creating a fresh and appealing group personality, and Bell takes note of several current jazz trends. Listeners will be surprised and delighted by what is accomplished under such seemingly deseriptive titles as *Latin Festical, The Gospel,* and *The Last Sermon.*

Don Ellis: How Time Passes
Candid 9004

Twenty-seven-year-old Don Ellis played trumpet in a long list of big bands without leaving any particular imprint as a soloist, became interested in the work of avant-garde classical composers, and now is attempting to combine jazz and twelve-tone techniques. His debut recording comes complete with impressive liner notes by Nat Hentoff and Gunther Schuller, who mention a number of contemporary composers but never get around to Schonberg. The old man of the movement may be considered too dated these days to pass as one of the avant-garde. However, the trumpet statements of Ellis, on the five compositions presented, carry the same strange fascination as the vocal utterances in the speech-song dramas of Schonberg.

Ellis gives the members of his quartet much more freedom than any classical composer would dare allow in a concert hall. His *Improvisational Suite*, No. 1, which occupies an entire twenty-two minute side, includes free-tempo sections that tax the imagination. Ron Carter, bass, and drummer Charlie Persip turn in a fantastic rhythm job and deserve a major share of the credit for keeping the performance organized and swinging. Jaki Byard, who alternates on piano and alto sax, contributes a descriptive African piece titled, *Waste.* One question left unanswered is whether Ellis would be an about average trumpet player in a conventional jazz setting. Still, there were equally doubtful moments during the eary part of Miles Davis' recording career. Bob d'Orleans engineered the date at Nola Penthouse Studios.

Jazz Artists Guild: Newport Rebels
Candid Stereo 9022

Jazz annals are dotted with rebellious causes, and the season that passes without a few salvos being fired in one direction or another is dull indeed. The annual Newport Jazz Festival usually produces a few skirmishes, but the crowning achievement of the 1961 program was apparently the concert given by a rejuvenated Judy Garland. Last year's affair was an entirely different matter, and headlines about battles between street rioters and police obscured news of a less gory reaction to the Roman Holiday atmosphere at Freebody Park. Dissenting musicians gathered nearby at Cliff Walk Manor, where they made a stand for the right to play without commercial restrictions, and this recreation of the event arrives at the appropriate moment to serve as a reminder that a jazz festival can avoid chaos and still be exciting.

"The big festival forgot about the music," says Jo Jones to explain one veteran's reason for joining the rebels, and he was supported

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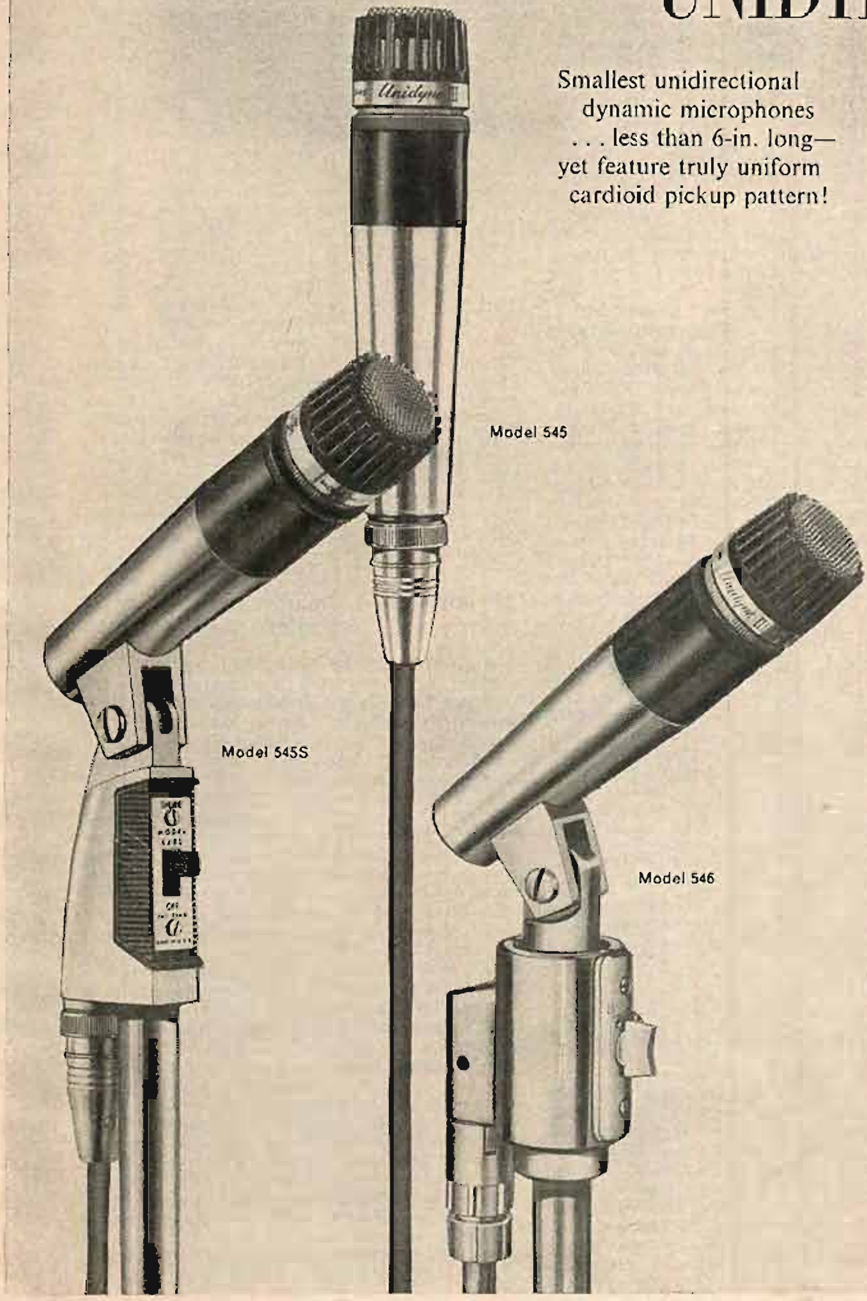

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in his action by Roy Eldridge and Coleman Hawkins. Perhaps the healthiest aspect of the entire project was the decision of organizers Charlie Mingus and Max Roach to welcome musicians of all age groups and not set up ground rules limiting styles. Plans to discard set repertory and mix the older and younger jazzmen together in new groupings did not always work out in practice, but the idea was firmly implanted. As supervisor of the studio sessions, Nat Hentoff drives the point a bit further home, having exercised his influence to ensure fresh material and impromptu performances.

The Jazz Artist Guild was formed, with the help of a few late starters, after the rebels returned to New York. The intention to produce concerts died aborning, largely because the type of promotional genius scorned at Newport was lacking, but an alliance with Candid did get part of the group together in a studio.

Veteran collectors may be reminded of a similar incident in 1938, following the first Benny Goodman concert at Carnegie Hall, when Milt Gabler recorded protesting Chicagoans at a jam session for his Commodore label. After playing a memorable part in the concert as the band's pianist, Jess Stacy joined Bud Freeman, Eddie Condon, Pee Wee Russell, and other dissidents to reassert the cause of freely improvised jazz on the celebrated *Carnegie Jump* and *Carnegie Drag.*

More recent parallels might be drawn, but the fact that Chicagoans of the swing era and the Newport rebels of today both value the same basic principles should not be overlooked. The battle undertaken by the rebels is an ancient one, and it will need to be refought again and again. The younger modernists and the older players in the various groups heard here quickly find a common ground in the blues, with Mingus leading the way in a brilliant bass solo on his own ad-lib *Mysterious Blues.* Jimmy Knepper, Eric Dolphy, and Tommy Flanagan fall in line and take turns on richly expressive solos. The session brought Mingus and Roy Eldridge together in a studio for the first time, and the rapport established between them is especially close and rewarding on two quartet numbers. Eldridge delivers thoughtful and melodic trumpet line on *Wrap Your Troubles In Dreams* as Jo Jones dances through a drum chorus, and then Mingus impels everyone to probe deeply into the blues again on *Me and You.* Eldridge plays superbly, and his blues sentiments are worth the price of admission alone.

None of the rebels pretends to extend the boundaries of jazz on this occasion, but Booker Little shows originality in scoring a drum duet for Jones and Roach on *Cliff Walk*, the only arranged piece of the set. As the rapid exchanges between the percussion experts are more imaginative than most, Little's task is considerably lightened, and he leads the ensembles with strong, vivid trumpet statements. The meeting of the two drummers is another first, in stereo at least, and the recording by Bob d'Orleans of Nola Studios does the pair full justice. Also highly effective is the stereo blend between Abbey Lincoln's throbbing voice and Benny Bailey's deep trumpet tones on *Tain't Nobody's Business.*

Kid Ory: Kid Ory Favorites
Contemporary Stereo S10041/2

These 1956 performances were released in monophonic versions in the days when it was still possible to purchase a 10-inch LP. The lavish repackaging, which includes photographs and ample notes tracing Kid Ory's fabulous career, also provides the alternative choice of hearing the great tailgate trombonist stomp off in stereo. Roy Du Nann, who engineered the sessions, began working with the band when Ory rejoined the label about three years before. Together they succeeded in turning out the first LP's to recreate vividly and realistically the sound of a traditional band. Substantial sales caused other companies to prick up their ears, and the quality of jazz recordings began to improve in some quarters. Stereo techniques have also improved greatly since 1956, and Du Nann would have little trouble doing a better job today. The main advantage of stereo in this instance is the extra room given the rhythm section. A less chunky beat results, and the dynamic pulse of Wellman Braud's bass and Minor Hall's drums is light and lifting.

As the oldest living leader, with a 75th birthday coming up next Christmas, Ory often searches vainly for sidemen of equal experience and competence. His bands have been erratic during the last decade, but the 1956 unit was one of the best. Clarinetist Phil Gomez supplies the proper New Orleans flavoring on *Weary Blues, Careless Love*, and *High Society.* Alvin Alcorn is an assured lead trumpet, and Ory complies with such specialties as *Do What Ory Say, Mood Indigo*, and *Eh, La Bas.* After two volumes and seventeen numbers, Ory's trombone glissandi are as rugged and powerful as ever.

Cannonball Adderley: African Waltz
Riverside Stereo RLP9377

These ceremonial chants signal Cannonball Adderley's graduation to the world of big bands, and the sole regret is that the eighteen-piece unit operates only in a studio. The title tune is a spirited English import which hit the popularity charts as a single, both in this version and the original reading by the Johnny Dankworth orchestra. Ernie Wilkins worked out a spanking new arrangement for the Adderley crew, and the leader's alto sax is featured on the first recording of the Galt MacDermott tune to attain LP status. Wilkins also enlarges with telling effect on such topical small-group favorites as *West Coast Blues, The Uptown, Kelly Blue*, and *Blue Brass Groove.* Bob Brookmeyer is credited with *I'll Close My Eyes* and *Stockholm Sweetnin'.*

Cornetist Nat Adderley shares solo honors with his brother, and the whole group drives furiously and gives a surging lift to the ensemble passages. A band of this sort could fill the dance floor at Freedomland or summer resorts, and booking agents are missing a bet if they underestimate the value of the Adderley name. They should have no trouble selling a similar band on a seasonal basis next year. Solos by Brookmeyer, Oliver Nelson, Jerome Richardson, and Wynton Kelly barely tap the band's potential, and the realistic stereo of Ray Fowler's engineering at Plaza Sound Studios makes this outing sound like a promise of things to come.

Bill Russo: Seven Deadly Sins
Roulette Stereo SR52063

Since Bill Russo introduced his rehearsal orchestra on this label in an adventurous LP entitled "School of Rebellion," it has performed in concert and an engagement at Birdland left the natives thoroughly astounded. This sequel finds all twenty-two members in top form, ready to tick off a full quota of sins with unerring aim. Russo's work is in eight sections, with an opening theme and the requisite number of variations. Sin songs were among the earliest blues and jazz composers have depicted the pleasures of sin before, but Russo also directs a devastating attack on his subject. Humor and satire are his most effective weapons, and he launches them on barbed solos by Louis Mucci, Burt Collins, Don Sebesky, John Glasel and Don Mikiten.

A quartet of cellos, captained by Seymour Barab, helps to dispose of *Lechery*, aided by the lampooning trombone of Bill Elton. Ken Guffey's bass trombone is deployed against *Sloth*, which takes flight under Ed Shaughnessy's percussive blows. The large instrumentation and the skillful orchestrations create many sonic delights in stereo, however sinful they may be. Russo comes closer to a union of jazz and classical forms than any of the advocates of a musical "third stream." But the term is never mentioned on the liner, and full appreciation of Russo's inventiveness probably will be realized only in years to come. Happily, the music is lively and intelligible right now.

Bud Shank: New Groove
Pacific Jazz Stereo 21

As the album title indicates, Bud Shank plays in the harder style now in vogue, but the date's surprises are his return to baritone sax and the debut of a promising young trumpeter. Shank last recorded on baritone with

Chet Baker in 1954, and even then his tone was warmer and more gutty than the fashions of the time dictated. Studio calls for his services continued to ignore the baritone in favor of his smoother flights on flute, and alto or tenor saxes. Shank's current group works regularly at the Drift Inn in Malibu, and the leader is free to switch instruments at will. A lusty Harry Carney influence is evident on *Sultry Serenade*, and Shank's way with a ballad is direct and unaffected on his own *The Awakening.*

Carmell Jones is the latest youngster to don the mantle of the late Clifford Brown, and the resemblance between the two trumpeters' ballad styles brightens the session. Shank's alto sound on four other titles remains less unremitting than the harder players, and he complements the fiery trumpet perfectly in stereo on such brisk tempo numbers as *White Lightnin'*, and *Well You Needn't*. Dennis Budimir, guitar, Gary Peacock, bass, and drummer Mell Lewis complete the quintet.

Jonah Jones: Great Instrumental Hits
Capitol Stereo ST1557

Instead of allowing Jonah Jones to make the jazz album he so richly deserves by now, Capitol has seen fit to deliver righteous trumpet into the midst of a vocal group called The Swinginest Chorale. Jones managed to rise above these surroundings and come away from the first meeting unscathed. Brought back for a second encounter, he plunges in boldly and even succeeds in prodding and pulling the vocalists to a position less remote from his own high level of performance. At least, they serve to enlarge the stereo dimensions in which Jones operates when working with only his rhythm section.

With extra room to play around in, the trumpeter drops his muted ways once in a while and opens up enough to give a slight hint of how he would sound with a big band. The dozen hits selected are noted for melodic content, but all have consistently defied attempts to provide lyrics equally as memorable. The vocalists imitate instrumental riffs or invent appropriate scat phrases and cast them gaily about in stereo on movie themes from *Picnic*, *The Third Man*, and *Moulin Rouge*. Pianist Teddy Brannon, bassist John Brown and drummer George Foster loyally supply the quartet's danceable shuffle rhythms on *Poor People Of Paris*, *Cherry Pink*, and *Sleepy Lagoon*.

Bob Gibson: Yes I See
Elektra Stereo EKS7197

The youth with a fetching personality is much in demand these days on the folk-music circuit, where the most sophisticated audience falls an easy prey to boyish high spirits, and Bob Gibson has enjoyed happy hunting since starting out seven years ago. But the time has come for the boy to grow older, and Gibson's clear tenor voice digs more deeply into the substance of a dozen songs on this LP than ever before. Part of this new maturity stems from a number of arrangements which Gibson worked out alone or with Bob Camp, his colleague on many club dates, and they give increased dimension to such traditional melodies as *By And By*, *Gilgarry Mountain*, and *Well, Well, Well*. Although the settings incorporate all that Gibson has learned about pleasing the patrons, they also include what experience has taught him about revealing the inner meaning of a song. Not that any of Gibson's natural ebullience is missing, but proper tempering gives it a wiry strength not too commonly possessed by the younger crop of folk entertainers.

Gibson, who first made a reputation at Chicago's Gate of Horn, journeyed to Los Angeles for the recording, where a local vocal septet called the Gospel Pearls is making itself known. They meet on several selections, and the folk singer's healthy enthusiasm merges excitingly with the volcanic fervor of the gospel group, particularly in the stereo version which John Norman engineered at RCA's West Coast studios. Gibson is also more selective of his material than many contemporary banjo pickers, uncovering choice items recorded as infrequently as the title tune, *Daddy Roll 'Em*, and *Blues Around My Head*.

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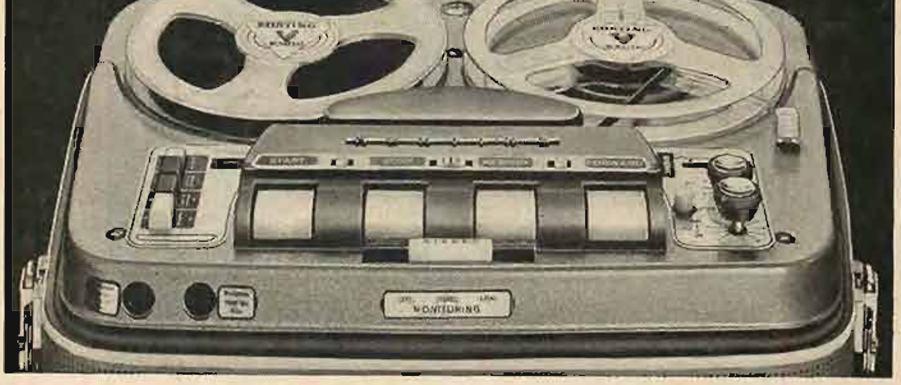

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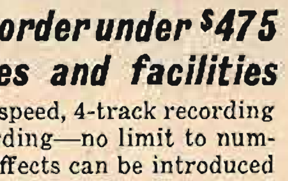

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LECTRODEX—the electronic magazine index—has been expanded to include over twenty five publications in the radio and electronics fields. Sold by subscription only, $3.00 for one year, $5.50 for two years. Back Annuals are available for the years 1947, 1949, 1951, 1952, 1953, 1954, 1955, 1956, 1957, 1958 and 1959 at $1.00 per Annual Postpaid. Order your subscription and Annuals today! ! !

RADIO MAGAZINES, INC.
P.O. Box 629, Mineola, N. Y.

Shelly Manne: The Proper Time
Contemporary Stereo S7587

This is a studio recreation of the soundtrack for the film "The Proper Time," and members of Shelly Manne's sextet are given more room to develop solos than when they improvised the original score. Manne was engaged to handle the musical chores by Tom Laughlin, who as writer, director, producer, and star does just about everything else in the production, and his orders were to avoid the pseudo-jazz that is currently so popular in movies and television. Apparently unaware that Miles Davis had already turned the same trick for a French film, Manne decided to assign his men various roles and have them follow the action by improvising on themes prepared beforehand. The plot revolves around young love and a sensitive hero who stutters when the pressures of adolescence become too much for him. Joe Gordon's trumpet, accompanied by Manne's hesitant drum accents, undertakes the part of the boy hero. Rickie Kamuca's tenor sax portrays the virtuous heroine, and Victor Feldman's vibraharp becomes the theme instrument for her sensuous rival.

The score contains several attractive blues themes, and many viewers of the film will undoubtedly regard it as a refreshing change from the usual Hollywood jazz formula. Despite the extra solo space allotted on this version, the music still belongs in the section of the jazz library reserved for background listening. An intimate stereo setting, engineered by Roy Du Nann, makes it a pleasant addition.

Edith Piaf: More Piaf Of Paris
Capitol Stereo ST10283

If this country's lyricists and composers did as well by our female vocalists as their colleagues in France are doing for Edith Piaf, large portions of the current repertoire could be put out to pasture for a well-earned rest. Everything from rock-and-roll profits to Top Forty programming is cited to explain why better songs are not being written. Perhaps the most valid excuse is that there is only one Piaf, as anyone can testify who has heard the carnage wrought over here on the English translation of Marguerite Monnot's *Milord*. Even the composer, who also wrote the hit musical "Irma La Douce," might fail to recognize her offspring in some of the guises that filter over the airwaves. Piaf sings it as it is meant to be sung, with a street gamin's courage, a bit of pathos, and the indomitable will to survive.

Other writers who lend support to the demoniac little performer on her latest album are Michel Rivgauche, the Moustakis, Jacques Prevert, and her personal conductor Robert Chauvigny. Piaf barely stops for breath while running through the gamut of the dramatic sweep of *Hurricane*, the nostalgia of *The Old Piano*, and the tenderness of *Heart's Cry*. The entire act benefits from spacious stereo.

FOUR-TRACK STEREO TAPES

Milt Jackson & Ray Charles: Soul Brothers
Atlantic ✪ ALC1913

Although the quality of jazz recording has improved tremendously in the past decade and received a big boost with the advent of stereo, a four-track tape often reveals aspects of a performance that are obscured or only dimly in focus on disc. In this instance, the victim appears to be Connie Kay, who was cited in various record reviews as being the wrong drummer for this sort of date and accused of maintaining too subdued a beat to incite the sextet's more soulful members properly. Even so, Kay works harder and holds less in reserve than he does in his regular post with the Modern Jazz Quartet, and any additional increase in volume would require a drastic change in style.

With the larger instrumentation, some concentration and a good pair of ears are needed to catch every sound of Kay's drumming, and his more subtle dynamic graduations are either difficult or impossible to follow on disc. Even when heard in stereo on good equipment, Kay fails to make a big impression on the disc version until he resorts to tom toms on *Cosmic Kay*. The tape version is something else, and the extended high-frequency range lets every bit of cymbal sheen shine through with stunning clarity. Far from being a debit on tape, Kay becomes the sonic star of the session.

The choice of Kay was probably dictated in the first place because the album was supposed to introduce Ray Charles as a jazz artist, and Kay is about as far removed from the ordinary rock-and-roll drummer as it is possible to get. If just a *few* of the many admirers of Charles buy this tape, they will discover what a real jazz rhythm section is like. With the late Oscar Pettiford as bassist and guitarist Skeeter Best assisting, Kay bolsters the entire date and never becomes discouraged. Charles displays his usual commercial acumen as pianist and alto saxist, while Milt Jackson performs nobly on vibes.

Andre Previn: The Previn Scene
MGM ✪ STC3908

Excerpts from three albums are arrayed on this four-track tape in an effort to survey Andre Previn's multifarious musical activities, but another dozen would still fall short of turning the trick. Emphasis is placed on the properties which have proven to be of greatest commercial worth, and seven numbers feature the youthful pianist in tunes of sweet romance against the lush playing of the David Rose strings. Nary a hair on Previn's head is ruffled by the smooth backing on *Young And Tender*, *Little Girl Blue*, and *Too Young To Be True*.

Previn's scoring for films receives a passing glance via two selections from "The Subterraneans," played in a trio setting with Shelly Manne and Red Mitchell. The stereo highpoint occurs when Red returns with Whitey Mitchell and the two bassists unite in brotherly resistance on *Get Those Elephants Outa Here*. The other septet number from the same session is the slow, soulful *Blues For Brian*. All the jazz fan needs do now is find a devotee of mood music willing to split the tape's cost, and a deal between the right parties might even result in listening to the romantic strings together.

Sammy Davis Jr.: The Wham Of Sam
Reprise ✪ RSL1703

Witnessing Sammy Davis, Jr. at work has all the fascination of seeing a trapeze artist perform. The entertainer hangs on so many cliffs during an act that it only seems a question of whether his voice or energy will give out first. A taped program removes any risk of the singer faltering, but there is still danger of living room walls cracking from the shaking received when Morty Stevens conducts a large orchestra in a typical Las Vegas production. Davis, who belts out six numbers in vigorous nightclub fashion, seems ready for more after *Out Of This World*, *Lush Life*, and *The Tender Trap*. Stevens allows ample room for stereo interplay between percussionists Larry Bunker and Shelly Manne. Marty Paich's arrangements for jazz nonet tone things down somewhat on the balance of the tape, and Davis slips easily into the more intimate surroundings to deliver *Bye Bye Blackbird*, *Soon*, and *Thou Swell*. The sonic treats here are Jack Sheldon's trumpet and Red Callender's tuba, along with Paich's idea for putting them to good use.

MONOPHONIC

Etta Jones: Something Nice
Prestige 7194

With one reservation, this sequel to "Don't Go To Strangers," which last year introduced Etta Jones to purchasers of LPs, is fully as satisfying and should meet with equol success in the market place. It seems unfortunate that the late Lem Winchester appears on only two numbers, as he complements the singer perfectly. They make a great team on *Easy Living*, and *Canadian Sunset*, with the vibist playing melodic and constantly swinging solos and background fills, and his absence is felt strongly on the rest of the set. Otherwise, Miss Jones works with two separate rhythm sections, much as she would in an intimate club, and always treats the lyrics as though they were written just for her. A slight resemblance to the late Billy Holiday is apparent on *Easy Living*, as might be expected, but this singer is no mere imitator and her style is wholly individual on *Till There Was You*, *Fools Rush In*, and *My Heart Tells Me*. She deserves the backing of a small all-star group, and Prestige should try to arrange one for her next album.

Lionel Hampton: Swing Classics
RCA Victor LPM2318

These dozen reissues comprise some of the best work Lionel Hampton ever did, and the album title makes no mistake in hanging the working classic on the entire lot. After Hampton's rise to prominence as vibraphonist with the Benny Goodman quartet, Victor launched him as leader and vocalist in a series of small-group recordings that continued from 1936 to 1940. Sidemen from the Ellington, Basie, and Goodman bands flocked to the sessions, and the collective personnel includes the outstanding names of that or any other period in jazz. Red Allen, J. C. Higginbotham, Jonah Jones, Jess Stacy, Chu Berry, Benny Carter, and Coleman Hawkins are only a few of those who can be heard responding to Hampton's irresistible rhythmic drive. Nat Cole was still unknown as a singer when his trio accompanied Hampton's two-fingered piano flights on *Central Avenue Breakdown* and the drum workout on *Jack The Bellboy*. Stanley Dance contributes informative notes, and the sound is surprisingly good for the time. Not only is this LP a must for any collection, but little dust has gathered on such numbers as *Ring Dem Bells*, *Whoa Babe*, and *When Lights Are Low*.

(*Continued on page 82*)

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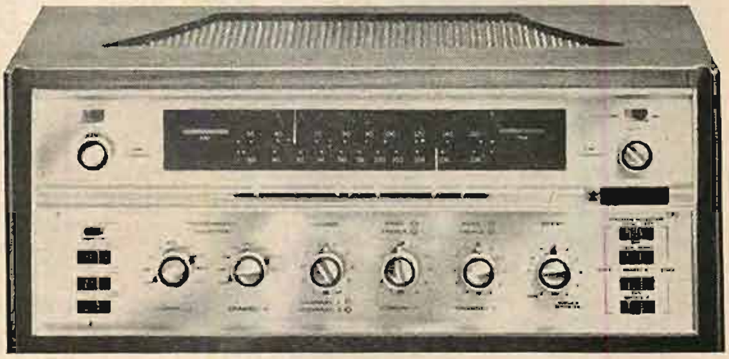

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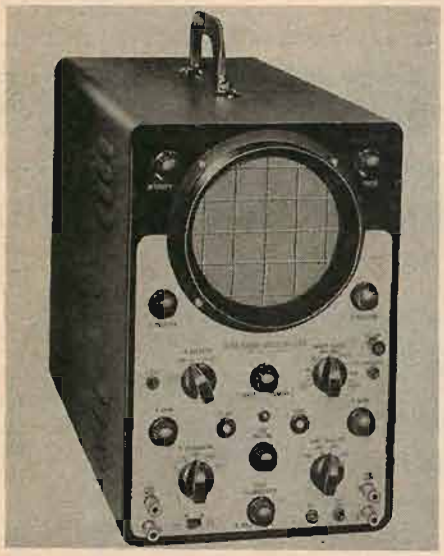
NEW PRODUCTS

• **Wide-Band Oscilloscope.** The new Precision Model ES-150 is a deluxe, laboratory-type instrument, covering the range from d.c. to 5 megacycles. The vertical channel is a 3-stage, push-pull, balanced d.c. amplifier, with a polarity reversal switch for convenient inversion of alignment patterns and trace comparisons. The d.c. sensitivity is 70 mv/in. and the a.c. sensitivity is 25 mv rms/in. The frequency response for a.c. is 3 db from 1 cps to 4.5 megacycles, and 5 db at 5 megacycles. Rise time is better than 0.08 μsec, and the input impedance is 1.5 megohms shunted by 0.023 μf. The four-step vertical input attenuator is frequency compensated. The horizontal channel uses a push-pull output amplifier having a sensitivity of 0.6 volts rms/in. The frequency response is within 3 db from 1 cps to 400,000 cps. Input impedance is 5 megohms shunted by 0.023 μf. The unit has automatic "positive" and "negative" synchronization; a printed circuit amplifier; a built-in peak-to-peak voltage calibrator; and an adjustable light control. The price is $149.95. Precision apparatus Company, Inc., 70–31 84th St., Glendale 27, N.Y. **J-1**

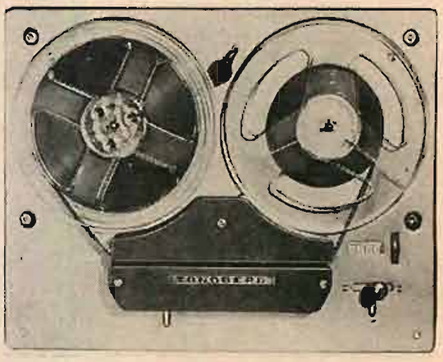


• **Portable Professional Tape Recorder.** Only 6¾" high, 4½" wide and 3 1/16" long, the new Sony all transistorized tape recorder, Model EM1, weighs a scant twelve pounds. Developed for the interviewer to carry with a strap looped over his shoulder, the EM1 will literally take a load off the back of the radio stations' "man-in-the-street." The tape transport is driven by a spring motor, and its amplifier operates on six penlite batteries. Monitoring while recording and reproducing is possible through an earphone. It is distributed in the United States by Superscope, Inc., 8150 Vineland Avenue, Sun Valley, California. **J-2**

• **Compact 3-Speaker, 2-Way System.** The new Jensen Model TF-2 incorporates a new 10-in. "Flexair" high compliance woofer and two direct radiator tweeters. The frequency range of the system is 25–14,000 cps and with a crossover at 2000 cps. Power handling capability of the system is 20 watts. Input impedance is 8 ohms. Two cabinet styles are available: all walnut, and an unfinished utility model with a smooth sanded, three-quarter inch, gum hardwood. Dimensions are 3⅛ x 23¾ x 11⅝-in. The enclosure is of the tube-vented "base superflex" type for linear, long-travel woofer excursions. The price is $64.50 unfinished and $79.50 in oiled walnut. Jensen Manufacturing Company, 6601 S. Laramie, Chicago 38, Illinois. **J-3**

• **High Impedance Headsets.** Higher impedance and greater sensitivity are featured in the new Mark III Telex headset. Intended for applications ranging from language teaching and general communications to audio analgesia, the Mark III is believed to have the highest impedance of any headset on the market (200,000 ohms). Frequency response is 50 to 9000 cps; sensitivity is 120 db at 1000 cps and at one mw input. Designed to resist pampering and damage, the Mark III can be sterilized to meet multiple use requirements. The d.c. resistance of the Mark III magnetic driver allows simplification in the amplifier circuit. A new design in foam rubber ear cushions with secondary ear shields provides reduction of ambient noise and improvement of comfort (air-filled neoprene cushions are available at less cost). Comfort is augmented by a plastic covered headband which is adjustable in seven ways. The Mark III weighs 12 ozs. Dept. KP Communications Accessories Division, Telex, Inc., 1633 Eustis St., St. Paul, Minn. **J-4**

• **Stereo Playback Tape Deck.** A new addition to the Tandberg line, the Model 65 is a 3-speed, 4-track, playback tape deck. It features a playback head for 2- and 4-track stereo and monophonic tapes, start-stop button, two outputs for plug-in preamplifiers, and facilities for adding record and erase heads. Adaptable for language laboratory or industrial use, the new model offers up to eighteen hours of listening. Frequency response at 7½ ips is within 2 db from 30 cps to 16,000 cps; at 3¾ ips, it is within 2 db from 40 cps to 11,000 cps; and at 1⅞ ips it is within 2 db from 50 cps to 5500 cps. It utilizes a hysteresis-synchronous drive motor and features single operating lever for playback, fast forward, and fast reverse. It incorporates a four digit revolving counter and weighs sixteen pounds. The price is $199.50. Tandberg of America, Inc., Pelham, New York. **J-5**



• **Tape Editing Block.** A smaller version of the professional EdiTall tape editing block is now available from the Tall Company. The miniature S-2 EdiTall block designed for modern compact tape recorders, is fully as precise as the larger S-3 EdiTall. The new block dimensions are 4" long, ¾" wide, and only ¼" thick. The S-2 is easily fastened to any tape recorder's top deck by means of the double-sided, pressure-sensitive adhesive tape which is attached to the block. The block is available in a kit, KS-2, which also includes a china marking pencil, a roll of 7/32-in. splicing tape, instruction booklet condensed from the "editing" chapter in Joel Tall's book "Techniques of Recarding." The S-2 block is $6.50 and the KS-2 is $7.50. The Tall Company, 27 East 37th Street, New York 16, N. Y. **J-6**

• **Multiplex FM-Stereo Generator.** H. H. Scott, Inc., Instrument Division, *announces* the availability of the Model 830 Multiplex Stereo Generator, believed to be the first piece of multiplex testing equipment available. The Model 830 operates in conjunction with an FM signal generator, an audio oscillator, and an oscilloscope to provide a composite stereo signal in conformance with the recent FCC multiplex

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H. H. Scott's published specifications on the 222B Stereo Amplifier are not correct! Nor are the published specifications for any H. H. Scott component. *Actually, units off our production line far outperform our claims.*

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H. H. Scott tuners also exceed their advertised specifications. "High Fidelity Magazine" says the 314 FM tuner "is very sensitive and stable and meets or exceeds the manufacturers specifications in every respect . . . Its sensitivity, rated by IHFM standards, is 2.5 μv according to Scott and 2.2 μv by our measurements".

Because of our conservative ratings you can be certain your H. H. Scott components will *always* meet or exceed the specifications on which you base your purchase.

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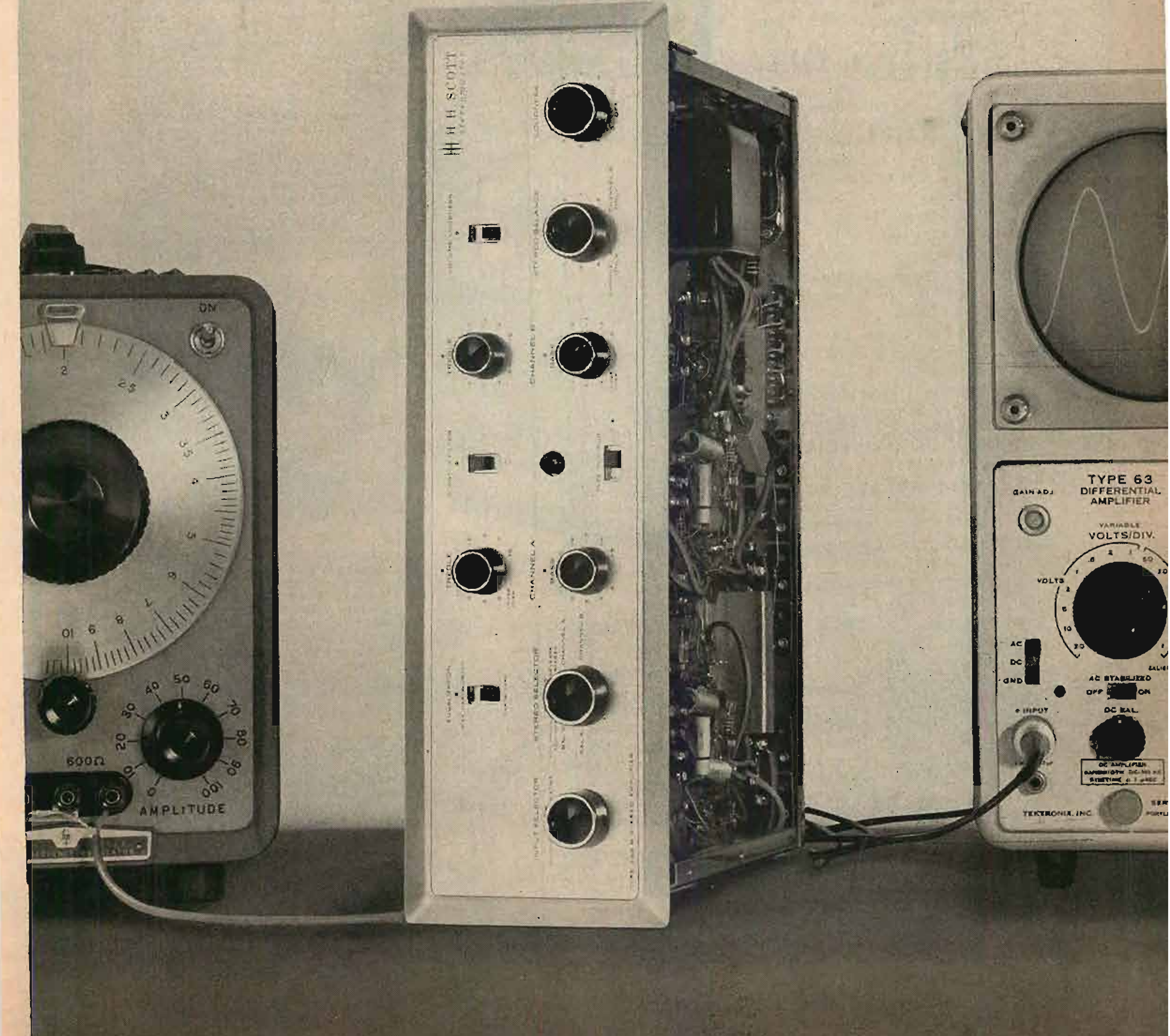
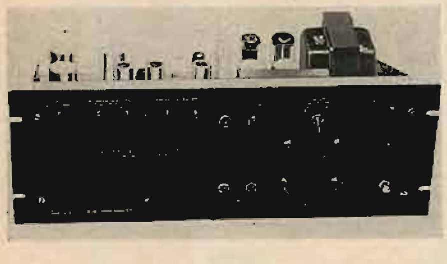


decision. Left and right channel from a stereo record or tape may also be used as an input to provide a composite signal for listening tests of multiplex receiving



equipment. The price is $1000.00 f.o.b. Maynard, Mass. H. H. Scott, Instrument Division, Inc., 111 Powdermill Road, Maynard, Mass. **J-7**

• **"Walk-around" Condenser Microphone System.** AKG, Viennese manufacturer of microphones, has just introduced a high-quality miniature condenser microphone, Model C60, teamed with a transistorized, rechargeable, power-pack, Model B60, permitting use in locations remote from a.c. power lines. Although it can be also used with a conventional a.c. power supply in the studio, the C60, with B60 power pack, is ideal for field recordings, broadcast reportage, on stage, and other situations where mobility and high audio quality are required. The C60 microphone is only four inches long and weighs two ounces. Response is smooth from 30 cps to 30,000 cps. It has two capsules, cardioid and omni-directional, which are interchangeable in seconds. Accessories include a new and highly efficient type of wind screen, a very light bamboo "fishpole," and extra-long cables. The B60 power pack, just a

hair over a pound in weight, gives twenty hours of service on a single charge from any 110/245 volt a.c. outlet. Shoulder strap and recharging unit are available, as well as a flexible shaft to permit mounting the microphone on the power pack for use with the shoulder strap or as a table stand. The price of the C60 with either capsule and the B60 power pack is $259.50. Electronic Applications, Inc., Stamford, Conn. **J-8**

• **4-Speed Belt-Driven Turntable.** Rumble and flutter caused by motor motion are drastically reduced in the new ESL T200 Series "Gyro/Spension" turntable. Belt-driven, this 4-speed turntable features an ingenious motor mounting, which is claimed to cancel vibration of the motor capstan at the point where it contacts the turntable drive belt. The compliance of the belt itself further removes rumble and flutter-causing vibration. Performance

characteristics are unaffected by tilting of the motor or turntable. The distinctive shape of the aluminum turntable increases flywheel action for smoothest rotation. The ESL T200 turntable is available with a 4-pole induction motor at $49.95, and is also available with a hysteresis synchronous motor (Model ESL-T200H) at $69.95. An oiled walnut base is available at $10.00 additional. Electro-Sonic Laboratories, Inc., 627 Broadway, New York 20, New York. **J-9**

• **Adapter, Phono-Jack Input to Tini-Plug Output.** This new Switchcraft Adapter No. 370 was especially designed to meet the needs of hobbyists, audiofans and hams. This adapter solves the problem encountered when a connecting cord ends with a phono plug and the female connection is a "tini-jax". The No. 370 has a "tini-plug" (tip 9/64 in. diameter × 9/16 in. long) finger output to phono-jack input, nickel-plated and completely shielded straight through connections, tip-to-tip, body-to-body. List price is $1.40. Switchcraft. Inc., 5555 N. Elston Avenue, Chicago 30, Ill. **J-10**

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NEW LITERATURE

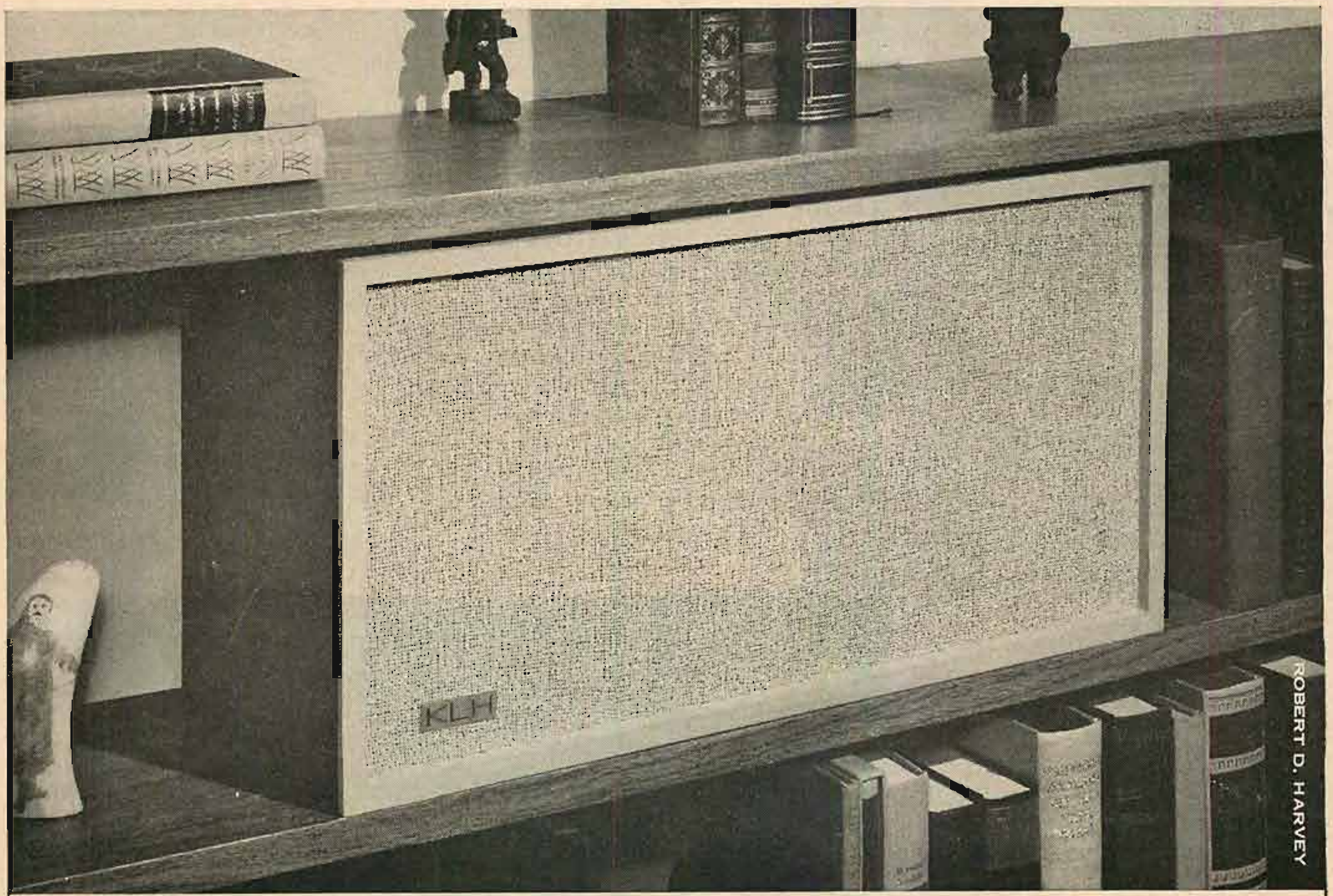
• **High-Fidelity Equipment Catalog.** Altec's new stereo high-fidelity catalog AL1302-1, entitled "Altec, The True Sound of Music," points out the return of larger speaker systems. Highlighted among the new professional sound products is Altec's 309A stereo tuner and 707 stereo tuner amplifier, each having built-in multiplex switching controls and output to facilitate recently approved FCC FM-stereo systems, and Altec's forthcoming 359A stereo multiplex adapter. Introduced for the first time in Altec's catalog are three new microphones, 681A and 682A, both omnidirectional in pattern, and the 683A with a cardioid pattern. Each is designed specifically for the serious home recordist or semi-professional motion picture enthusiast seeking professional results with his equipment at home. Included in the catalog are Altec's line of speakers, matched speaker components, speaker systems, and an illustrated section recommending stereophonic or monophonic arrangements. A copy of the booklet may be obtained from any authorized Altec distributor, or by writing to Dept. LB, Altec Lansing Corporation, 1515 So. Manchester Avenue, Anaheim, California. **J-11**

• **AM–FM Radio TV Station Listings.** Listing over 7000 stations plus FM stations by frequency, the new Jones "AM, FM, TV, Radio Station Listings," Volume No. 3, has just been made available. In addition to all the previous features, the listing gives the effective radiated power of FM stations; FM, AM, and TV stations in one comprehensive list arranged alphabetically by call letters; and frequency of all stations in the call letter list. The lists were compiled from official FCC information and includes the United States and possessions, Canada, Cuba, Mexico, and the West Indies. The price of the booklet is $1.00, from the Vane Jones Company, 3749 North Keystone Avenue, Indianapolis 18, Ind.

• **EICO Catalog.** A new 3-color, 28-page catalog covering its complete line of stereo and mono high-fidelity equipment, test instruments, ham gear, citizen's radio, and transistor radios has been announced by EICO Electronic Instrument Company, Inc., 33-00 Northern Boulevard, Long Island City 1, New York. The catalog features EICO's new Medalist series of high-fidelity equipment, numerous new test equipments, ham items, and a new citizens' band transceiver. In all, over 80 items are fully described in the catalog. It is available by writing to the company at the address given above. **J-12**

• **Miniature Hi-Fi Speaker System Brochure.** Brochure LX illustrates and describes Jensen's Model X-10 ultra compact 2-way speaker system. This system makes it economical and practical to extend stereo to other rooms in the home, receive FM or FM-stereo, and solve compact hi-fi installation problems. The brochure is available without cost from Jensen Manufacturing Company, 6601 So. Laramie Avenue, Chicago 38, Illinois. **J-13**

• **Sound Effects Catalog.** A new 56-page catalog describing over 1500 different real-life sound effects has just been published by MP-TV Services, Inc. The more than 250 records include sounds of modern jet aircraft, animals, autos, crowds, household, industrial, music, trains, war and guns, weather, documentary, and many others. Catalogs may be obtained for $.25 from MP-TV Services, Inc., 7000 Santa Monica Blvd., Hollywood 38, Calif.



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Saul J. White
Chief Engineer, Audax, Inc.

No. 5 FOURIER, NAPOLEON & MARILYN MONROE

We usually visualize a sound wave as a simple harmonic wave, for we remember our first lesson in wave motion wherein we were shown the results of a stone dropped into water.

This is actually a great simplification, for sound waves, such as surround us in our daily lives, are extremely complicated in shape structure. If loudspeakers were concerned only with the reproduction of smoothly undulating sine waves, such as emitted from a range of tuning forks, we would long ago have achieved the nearly-perfect loudspeaker. If one compares several loudspeakers using the tone from a distortionless oscillator, there is not much difference in sound quality between the various speakers unless overdriven.

But let us next listen to each speaker reproducing the sound of a tin can bouncing along the street, and we at once notice wide differences. An orchestra or the sound of applause, or clapping of hands will not sound alike on any two different brands of loudspeakers, because the tortuous complexity of the wave shape has placed several kinds of labor in varying degrees upon each speaker. This has to do with the dissimilar kinematic behaviour of the diaphragms. No loudspeaker can exactly follow a square wave.

Few musical instruments emit sinusoidal tones. Nearly all are complex, because of their harmonic components. The wave shape in any short period of time is further altered by the superimposition of many instruments as in an orchestra. This complex and irregular wave pulse stresses the loudspeaker and separates the tadpoles from the frogs.

A single sine wave of sound is extremely rare unless synthetically created. This is true of optical waves as well as sound. The sounds on the face of the earth, machines, the singing of birds or men, the noise of the surf, the wind, rain and storm, your city symphony or favorite crooner all have a complex structure abounding in harmonics and overtones. They never resemble the smooth ripples sent out when a stone is dropped into a pool.

The simple sine wave is just a handy concept for analyzing more complicated wave effects. About 150 years ago, the mathematician Fourier excited great attention by his assertion that by a suitable choice of simple sine waves of different frequencies, any prescribed complex wave could be constructed. This seemed at first unbelievable. What about repetitious curves with sharp corners, with needle point spikes, square waves and saw-tooth curves or curves with all kinds of humps and dips within each time period? Fourier was able to prove with mathematical precision that his method held good for all cases.

The process of analyzing a curve consists of finding the particular numerical values of the coefficients of the Fourier equation so that it will represent the given curve. It is possible to reproduce mathematically the curvaceous silhouette of Marilyn Monroe with reasonable likeness using about twenty-five coefficients. It is a long and tedious process. Better to buy a pin-up calendar.

Fourier, (Jean Baptiste Joseph, 1768-1830) was employed by Napoleon to compute gun fire and the trajectory of cannonballs. He accompanied Bonaparte on campaigns. He was more than a mathematical genius, he was a capable statesman, highly cultured, encouraged literature, a political liberal, and for a time governed lower Egypt. Like Lord Rayleigh he made many contributions to mathematics and science without much recourse to experimentation or objective physical testing of his theories. What is known as the "Fourier Series" for a time upset the theory of functions. The situation was saved by others who showed that the Fourier series of a continuous function is summable by the method of arithmetical mean.

Each week I examine dozens of sound waves, observe their pattern on the oscilloscope and hear them via loudspeakers. I never cease being amazed that a fragile paper diaphragm can do such a credible job. If I strike a chord on the piano holding down three keys, I am listening to the *effect* of hundreds of smooth acoustic ripples acting simultaneously on my basilar membrane. Amazing!

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ABOUT MUSIC

HAROLD LAWRENCE*

Richter In London

BY THE TIME Sviatoslav Richter made his first appearance in England on July 8, interest among Londoners had reached a high point. Until his triumphant series of recitals in New York last fall, Russia's foremost pianist had never before performed in the West. A few of us heard him play in Russia, as well as in Warsaw, Prague and Sofia; and the Philadelphia Orchestra collaborated with him in a performance of Prokofiev's *Fifth Piano Concerto* in Leningrad in 1958. To the vast majority of music lovers outside of Russia, however, Richter was still a vague, legendary figure. Glowing reports were brought to the Western world by the pianist, Emil Gilels, and the cellist, Mstislav Rostropovitch, both of whom arrived in the United States with the first batch of touring Soviet artists in 1954. But the only direct evidence of his playing came from his prolific output of recordings, most of which were engineered in Russia. The British now had their turn to hear Richter early this year. Illness, however, forced the pianist to cancel all engagements in March and April, thus postponing his trip to London for another four months. Finally the dates were set: Richter was to play three solo recitals and two orchestral concerts in no less than ten days.

Richter's "Private World"

When it was all over, Richter left his English audiences impressed, but while all the critics agreed that Richter was one of the outstanding pianists of our day, some were plainly disappointed by the apparently limited dynamic range of his playing, and by his accent on introspection rather than virtuosity, qualities which the acoustics of the sprawling Royal Albert Hall probably helped to underline. From the nature of the reaction, one can assume that the press and public somehow had expected other things from their Russian visitor. This might explain the emergence overnight of a phrase written by a critic to describe the impression created by the celebrated pianist at his first recital: "The private world of Mr. Richter." The reference is to Richter's ostensible indifference to the public while in the throes of a performance. When a London *Times* reporter queried him on this point, Richter denied that he was ever unaware of his audience (no musician ever is), "but I know for sure that if I'm over-aware of an audience, then my concentration on realizing a composer's intentions lapses and I don't give of my best."

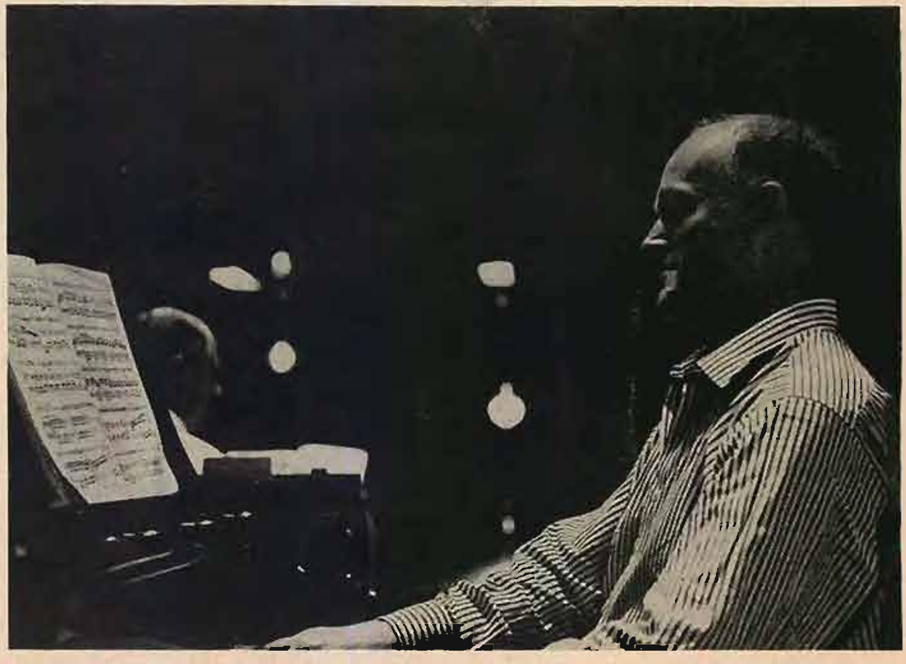

Fig. 1. Richter and Rostropovitch recording Beethoven. (Photo by Harold Lawrence.)

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26 W. 9th St., New York 11, N.Y.

Richter does not try to win over his public merely with the surface excitement of a virtuosic approach. His is a more profound conquest, based on superb technical control, a singing tone, and a clear projection of form and structure. It is axiomatic that a pianist should hear the color and intensity of each note in his mind's ear before he actually produces it. With many pianists, some notes just happen. Not so with Richter, whose playing is alive with expressive details, each a part of a broad, well thought-out concept. The concept may sometimes miss the mark—and Richter would be the first to admit that no single pianist holds the key to understanding of all styles—but it is invariably characterized by an extraordinary sense of unity and conviction. As for dynamic range, between his *pianos* and *fortes* lies a full spectrum of subtle dynamic shading, which probably accounts for the fact that Richter never finds it necessary to thump the keyboard.

Richter In the Recording Hall

The worlds of Mr. Richter, both private and otherwise, were placed under a magnifying glass during a series of recordings which the 47-year-old pianist made for Philips after his last orchestral concert in London. The setting was the Walthamstow Town Hall, one of England's most active recording sites. Standing by in the hall on the afternoon of the first session were two concert grand pianos, a Bechstein and a Steinway, along with their respective tuners. Not having recorded in Walthamstow before, Richter wanted to be sure that the instrument he used would be the best match for the auditorium's acoustics, and for the character of the works he was about to record with the London Symphony Orchestra—Liszt's two piano concertos.

In one of the most effective numbers in the Moiseyev Ballet repertoire, male dancers move swiftly across the stage, their legs completely hidden from view by long black capes. This gliding motion was what came to mind on meeting Richter for the first time. Silently, with effortless grace, his head cocked to one side as if listening to an inner musical conversation, Richter approached us in the control room, shook hands all around, and, accompanied by Kiril Kondrashin (his conductor in the Liszt concertos), proceeded directly into the hall. After tossing off a few arpeggios, some scales, and several resounding chords, Richter quickly made his choice. The Bechstein was rolled into position, and the session got under way.

Although Richter and Kondrashin had performed the Liszt concertos only the previous day with the London Sym-

(*Continued on page 86*)

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In each of the categories shown above, the results ranged from good to poor. As a matter of fact, only 10% of the samples met the Shure performance standards for the Shure N7D Stereo Dynetic Stylus. In addition to our test findings, our Service Department records show that an increasing number of Dynetic Phono Cartridges are being returned because of poor performance—and our examination has disclosed that most of these returned cartridges are using imitation Dynetic Styli.

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JAZZ AND ALL THAT

(from page 75)

Budd Johnson: Let's Swing **Prestige Swingville 2015**

In the last two or three years, more people became aware of the estimable qualities of Budd Johnson than all during a playing career that stretches back three decades and beyond. As bulwark of the sax sections in the Quincy Jones and Bill Evans bands, he made considerable impact on recordings and drew attention everywhere he appeared before an audience, Johnson always had the respect of fellow musicians, but the admiration he now enjoys from young and old is usually reserved for greater innovators or remarkable stylists. When Johnson sits in a band, however, he speaks with authority in the ensembles and each of his tenor-sax solos seems exactly right, regardless of period or style involved. Any popularity poll to select the perfect big band musician should result in a tie for first place between Johnson and Harry Carney. Count Basie is his latest employer, and the association should be productive of additional model solos for other players to shoot at.

With Keg Johnson on trombone to contribute brotherly reminiscences, the present release becomes a family affair, and the close ensemble work is a pleasure to hear. The trombonist growls mightily during muted passages on *Blues By Budd*. Pianist Tommy Flanagan assists admirably on three originals, and the quintet's other rhythm members are George Duvivier, bass, and drummer Charlie Persip. The featured soloist reveals again how a tenor player should sound in a leisurely approach to several facets of *Serenade In Blue, Falling In Love With Love,* and *Someone To Watch Over Me.*

Cannonball Adderley: Cannonball Enroute **Mercury MG20616**

Dating from the days when the Adderley brothers were under contract to Mercury, this release just goes to show that the label had a good thing and should have held onto it. Since the pair signed with Riverside and rocketed to success, Mercury belatedly issued another of their LP's titled "Cannonball Adderley Quintet In Chicago," which proved better than any of the quintet's previous work for the company. The present album belongs in the same category, and there is every indication that a more timely arrival on the market place would have hastened wide public acceptance of the quintet's product.

Along with the sessions Cannonball attended at Blue Note and Columbia while working for Miles Davis, the two albums show the alto-sax star rounding the corner enroute to fame and fortune. One of the most interesting and creative periods in a jazzman's career is when an individual style falls into shape, and Cannonball applies the finishing touches here during *Lover Man, A Foggy Day,* and *The Way You Look Tonight.* Nat collaborated with Ray Bryant in writing *18th Century Ballroom*, and wields his cornet on an early excursion into currently popular soul music on *That Funky Train*. Pianist Junior Mance, bassist Sam Jones and drummer Jimmy Cobb complete the quintet, but are rather dimly recorded.

The Barrel-House Blues Of Speckled Red **Folkways FG3555**

When rediscovered several years ago by a group of St. Louis blues enthusiasts, Speckled Red was working in that city as a porter and played only occasional jobs as pianist and entertainer. With an assist from Erwin Helfer's privately produced LP "Primitive Piano," which lists three titles by the pianist, the news filtered through channels to Europe, where excitement over early blues players often reaches fever pitch. As a result, not only are regular engagements available at home, but the 68-year-old veteran frequently goes abroad on concert tours. Dansk recorded this program in Denmark during a recent visit, and Folkways can chalk up another credit mark for releasing in this country the only LP devoted entirely to one of the few authentic and unspoiled folk artists.

Speckled Red was born Rufus Perryman near Atlanta, Georgia, and was making a living as an itinerant pianist before the first World War. He visited most of the cities and towns where employment was open and first heard many early piano styles from the originators. His specialties include hot and furious versions of *Pine Top's Boogie Woogie,* and Charlie Davenport's *Cow Cow Blues.* The rest of his experience is crammed helter-skelter into the barrel-house style which was most in demand during his formative years, and he uses it with slight variation on fast blues, pop tunes and such entertainer's numbers as *You Ain't No Good* and *Why Don't You Practise What You Preach?* This conglomeration is just the sort of thing that intriques blues collectors, and they delight in puzzling over the pieces. A producer in this country might have ruled out the vocalizing on pop tunes, but the Danes are more tolerant of *If I Had A Million Dollars* and *I Got A Feeling I'm Falling.* Besides, the songs never sounded the same before. Samuel Charters contributes a detailed analysis.

Mal Waldron: The Blues Minus You **Music Minus One MMO1011**

Some idea of how modern blues have grown in variety and expanded in form can be obtained from this set of trio accompaniments, which are designed to assist various horns at home practice sessions. All ten titles are recent compositions of Mal Waldron, who also wrote short descriptions and notated the themes for the instruction booklet enclosed, and he deems it necessary to divide the list into six categories. At that, traditional styles are considered only when used as a basis for modern derivations, and Waldron could easily cite a greater number of headings than ballad blues, church type blues, minor blues, backbeat groove blues, cookin' blues and modern

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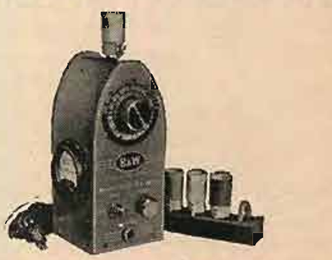

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disguised blues. The novice who expects to master this much of the idiom successfully should start with a thorough grounding in the older types of blues.

As the trio's pianist, Waldron demonstrates a close familiarity with the earthy beginnings of the various forms. Students anxious to make comparisons with the work of other instrumentalists can trace the titles to small-group recordings on the Prestige label. Charles Perry is the drummer, and bassist Wendell Marshall's firm backing, along with Dave Hancock's fine engineering job, will keep hesitant players on the right track.

The Greatest of Dizzy Gillespie
RCA Victor LPM2398

These dozen reissued selections cover Dizzy Gillespie's 1946 all-star septet and the second of his big bands, which was organized in the summer of 1946 and lasted until 1950. Half of the eight band numbers chronicle the rise of Afro-Cuban rhythms, with the leader collaborating with the late Chano Pozo on *Manteca,* and with George Russell, on *Cubana Be* and *Cubana Bop.* Walter Fuller tells how Gillespie took the new concept to Scandinavia on *Swedish Suite.* The band's bassist in 1947 was still Ray Brown, and he appears in the showcase *Two Bass Hit.* The septet sets the stage for the larger group on *52nd Street Theme, Night In Tunisia, Ol' Man Rebop,* and *Anthropology.* Anyone doubting the influence of Lionel Hampton on Milt Jackson should compare the vibes work here with Hampton's solos on the current reissued "Swing Classics," (RCA Victor LPM2318). Engineers have trouble today handling Gillespie's trumpet with a big band, and things were no different then. Æ

AUDIO ETC

(*from page 14*)

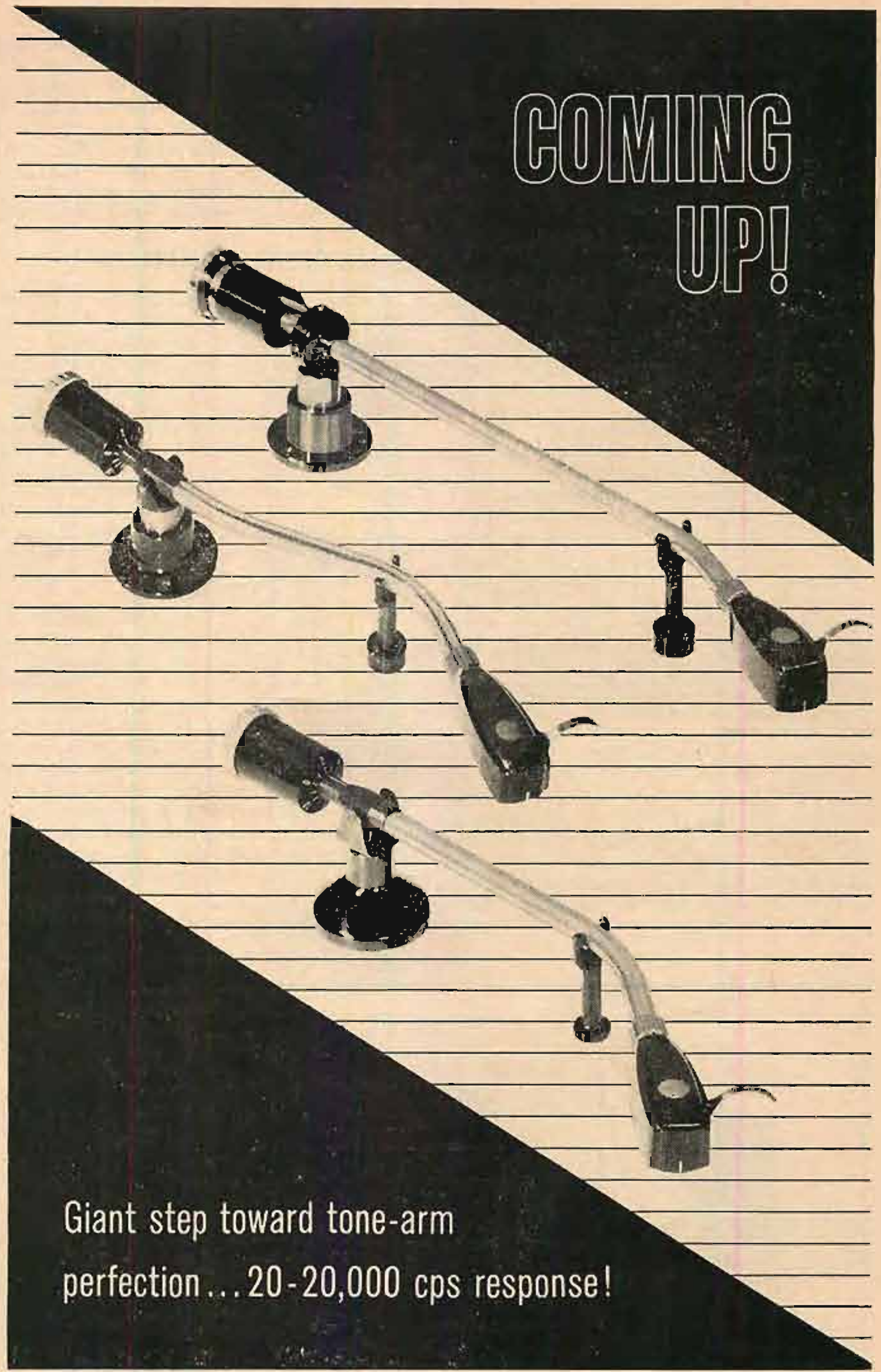
glasses to clean them. Whether this is inherent in the sound-system or was some species of room-effect, a coupling with my room space, I cannot say. It made speaking voices slightly metallic, but in most music I quickly forgot all about it. Generally speaking, this system produces a good sound from a component point of view and a marvelous sound in comparison with many an expensive competing "console."

Stereo? Most interesting. The sound-spray from the Reflection Coupler goes out the wall, semi-parallel, some of it bouncing back at varying angles and a lot of it continuing until an obstruction is met, to one side or the other. That obstruction ideally is a reflecting corner or equivalent. No great harm is done if a hard chair or a table or two intervene, but I'd suggest you beware of plush furniture at the sides anywhere near the unit. (There isn't a speaker in the world that can stand up to an overstuffed couch.)

The intention of the system, clearly, is to achieve a stereo spread by reflection, out of the plastic reflector units and with the help of the room corners to each side. The intention, I am happy to say, is quite realizable and with a reasonable minimum of finagling. You do hear "big" stereo from this system when properly set up. There is a very clear difference between stereo and mono—the acid test.

I found quickly what the Coupler's demands from me were. And its limits. First, it must be placed in a balanced position, equidistant from two identical or reasonably similar corners. As in all stereo, symmetrical positioning is vital.

When I put the unit about two feet from one corner and six or seven feet from the other, the stereo was small and cramped, the sound coming too noticeably from the back of the unit itself. But when I slid it sidewise so that the distance to the nearest corner was four or five unobstructed feet, immediately the sound was vastly improved.



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The unit itself was no longer an apparent source; the stereo spread out gratifying to occupy the whole side of the room.

In order to do this I had to seal off one door panel temporarily, usin gthe door as part of my back-wall reflection. In *all* stereo situations you must be ready to do things like that if you want good stereo sound, even with a unit of this sort, designed for maximum convenience. But, in compensation, I found that a standing record cabinet no higher than my head and a foot deep could act quite nicely as one "corner," allowing me to place the speaker bench somewhat off-center, not exactly in the middle. The effect is, indeed, quite flexible, just so long as you satisfy the system's need for a balance between one side and the other. That you *must* do. You are required to find the point on your wall where the speaker, so to speak, feels happy, and you ignore this at your own risk.

Finally, I found that Reflection Coupler stereo is decidedly best at a distance, across the room. Closer up, the stereo is only so-so, and at very close range—almost on top of the unit—you hear hardly perceptible stereo direct from the rear speakers, as you look down at them. Note that this is in interesting contrast to the usual situation with one-piece cabinetry for stereo, where good stereo sound is audible only from close to the cabinet. Chalk this advantage up to the reflection principle.

That's all there is to say, except to observe that the principle itself, rear-aimed speakers against the wall, aimed by curved sidewise reflectors, is applicable to many furniture patterns, A new model, the editor tells me, fits flat up against your wall, only a few inches thick and upright like a panel; that would be the new "thinsy" shape now becoming popular. Another trick idea is a Reflection Coupler sofa—a sofa with a back, of course, to be pushed up against the wall. No pillows along the top edge, but then you don't usually need head pillows for that kinds of sofa. The entire speaker system would be "inside" the sofa, with the tweeters mounted handily in the back section against the wall. Very nice.

3. CRYSTAL-TUNED FM

I have had a Karg Crystal Controlled Tunematic FM tuner on hand, Model CT-3 with 12 crystals and a remote control pushbutton station selector, for an outrageously long time. I haven't a good leg to stand on; just too many things pulling me in too many directions; and now I've gone and taken the thing to the most unlikely place for such a tuner, my country home where I can pick up 60 or so FM stations —not one of them less than forty miles away! Well, no matter; at least I can see where Mr. Karg's very special tuner can fit into the picture, and I'll be happy to pass on the information.

A friend of mine worked for a long while, a good many years back, on the first such tuner I'd ever seen in person. His worked by a telephone dial; you dialed your station. This one, the Karg, has a circular selector dial with a light behind it to illuminate each station name as you snap it into place. 12 crystals, turret-mounted, each unerringly ground for a particular frequency, and if you move to another location, Karg will exchange any of them for new ones at no cost, tossing in a general factory looking-over as part of the bargain.

The Karg people were ever so considerate of me—they set my tuner up with a whole ring of 12 local New York area FM stations, including such nice items as WBAI, the Pacifica Foundation outlet that doesn't have commercials (but does ask you to help it pay for itself) and, of course, my own WNYC, which gets paid for by the city, though I don't. There was WNCN, the Concert Network outlet, WPAT for news in New Jersey, and a solid network representation, WOR, WNBC, WABC, WCBS—the works. WQXR, naturally, the original good-music-and-commercials station, and then there was WRVR. . . . I deliberately cite all of these to give you an idea of how much twelve stations can amount to. Plenty.

Now here I am in Cornwall, Connecticut, and on the WRVR crystal I get a local outfit called WKIP, Poughkeepsie. I hear a faint shadow of WNYC, and a stronger shadow from the network outlets. WBAI just goes glubglubglub. It's a feeble signal, any way you tune it. WQXR's network affiliates are all around, but they don't fit this particular set of crystals, and the same with the numerous Concert Network stations nearby. I'm tuned fixedly to their New York outlets, far, far away. All of which shows how special a tuner this is. To use this one here, I would have to choose a new set of 12 stations and send in my crystals for replacement.

Of course the whole point is that the man who buys such a tuner has other very good reasons for doing so, and he will order his crystals as he wants them in the beginning. Choice of twelve. Given its specialness, a crystal tuner is a highly desirable item and decidely worth your consideration before you jump overboard to retrieve a standard, continuous-tune job that will bring in *all*

1

2

3

4

5

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the stations, good and bad, plus every bit of noise in between.

Why a crystal tuner? Two very good reasons. First, it is absolutely drift-free. Each station is locked permanently in exact tune. No AFC, no nothing. Leave it and come back a year later, it'll still be precisely tuned where you left it. This feature is vitally important in professional installations, where exact tuning must be automatic and unquestioned. The Karg unit has adapted the principle for home hi fi use, and with this tuner you will never need worry about out-of-tune wandering. Especially in recordings off the air, and very particularly in *unattended* recordings, the only sort that are of any use to most of us who take down music via FM. You can leave this machine to take care of itself with absolute confidence and you'll never miss a recording on account of it.

Second, these stations are discrete points, quite without dial-space between them. You don't move along from one to the next, you click directly. There is no inter-station noise pickup whatsoever. Very useful, like a TV set. (But TV sets get out of tune; this doesn't.)

As a result of this directness of approach, the numerous fancy controls on standard FM tuners are happily missing here. Just one big circular dial, plus an optional volume control that may be switched out. That ought to please many users.

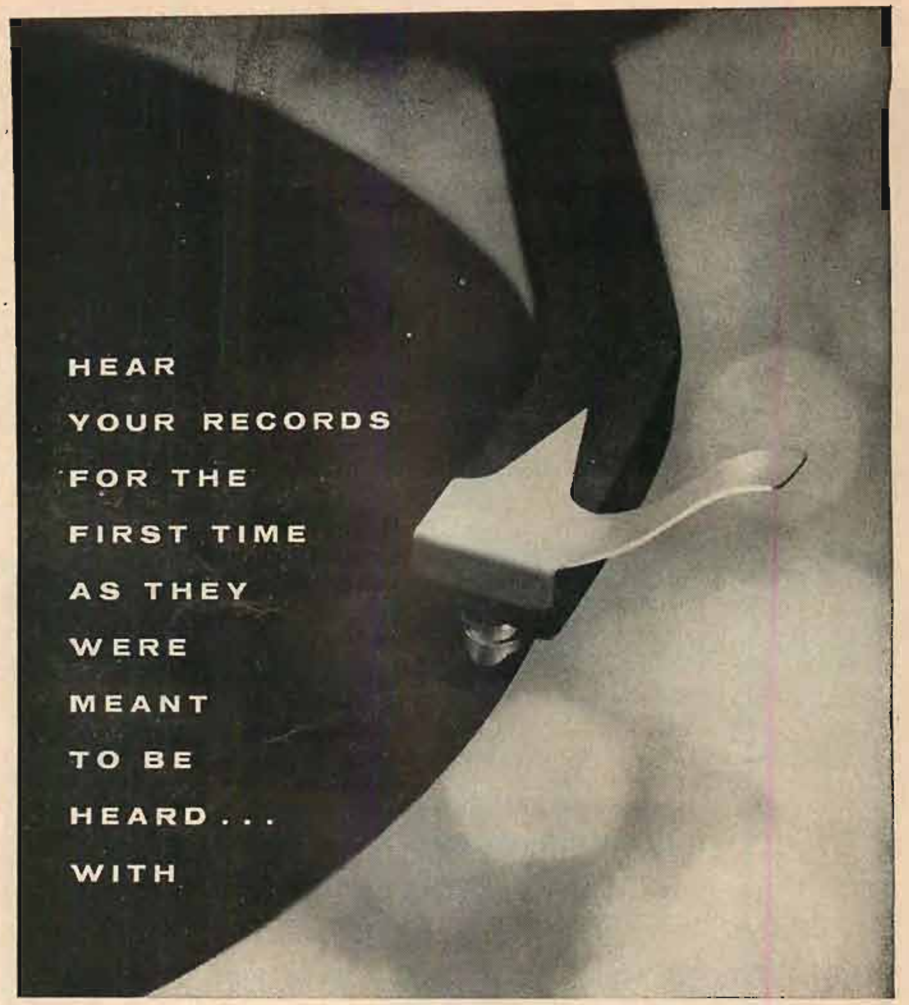
I should add that as far as I can determine on short trial by ear, the Karg lives up to its very high quality specifications, in line with its inherent potentialities for accurately perfect FM receptton. It looks the part, too, and takes up a lot less room than other tuners I've tried. It's a very refined, direct-purpose sort of instrument, concise and to the point.

Two points to add. The sensitivity of this tuner is not particularly high, in line with its intended use with high-quality nearby FM station signals. I would not suggest its use in extreme fringe-area reception, such as mine, even with a fancy antenna, unless you have your stations well chosen and want them to stay in tune or else. On the other hand, maybe 90 per cent of potential users are *not* in the fringe areas, or can at least pull in enough strong stations to cover all anticipated needs. For such people as these, I note that there are Kargs with 10, 8, and 6 channels at proportionately lower prices. For most people, six stations is a lot. Yes, I tune in 60, but in daily use I listen to three or four, most of the time. Just two will get me most of what I need in music and news.

Secondly, my Karg Tunematic came with the remote control attachment aforementioned. It may be your meat—a handy pushbutton at the end of a long, fat cord, and each time you push, the tuner moves on to another station, counter-clockwise. You can sit in your easy chair and tune away like mad without moving more than a thumbnail.

I didn't find it very helpful, myself. For one thing, there's that cord, just one more cable to tangle and trip over. This isn't wireless. Then, the motor only kicks the dial in one direction; if you miss, you have to go all the way around to get back again. Moreover, I found that when the remote is connected you can only move the dial by hand in one direction. Try it the other direction and it goes zzz, zzz, zzz. With the remote turned off, the dial moves either way by hand.

Suit yourself—some people love remote controls. I have one for my Fisher 400 CX stereo preamp, too, but somehow I've never got around to connecting it up. One more cable, again. Æ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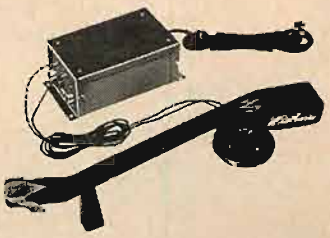

ABOUT MUSIC

(*from page 81*)

phony Orchestra, they nevertheless settled down to an intensive rehearsal. Kondrashin aimed for a tight rapport between solo and tutti, and a more precise ensemble within the orchestra itself. He conveyed his instructions to the players by means of a terse vocabulary made up of English, Italian (for expression marks, dynamics, and tempo), and Russian. His native tongue was used only for rehearsal letters: "M—Mikhail! N—Nicolai! (or) V—Vladimir!" At last, the Russians announced they were ready for the first 'take.' The recording crew was ready, too, having achieved a good solo-tutti balance while the rehearsal was in progress. There was nothing further to do but start the tape and film machines, and slate the first take of the session.

There is something about a playback that unsettles all but the most thick-skinned recording artists. Some performers walk the "mile" from the hall to the control room as if it were to their own executions, and cringe when they hear the first notes sound from the loudspeakers. It can be a painful, irritating, frustrating, and, on rare occasions, exhilarating experience, to which not even a veteran such as Richter is immune. In moments like these, his mobile features range in expression from keen disappointment (often punctuated by a deep Slavic sigh); to intense displeasure at hearing a slip; or quiet joy over a passage that struck home.

Richter, like many musicians, distrusts the post-mortems of recording (that is, the splicing of the tape), and will do everything he can to avoid the editor's blade. His approach to recording is a throwback to the 78-rpm era when a musician had to bring forth some four minutes of inspired, unblemished playing. He is almost fanatically opposed to "patching," the process of putting together a phrase, or a passage from multiple takes. His ideal of the "long take" will lead him to re-record entire works several times until he has achieved the finest over-all performance of which he is capable. In the case of the Liszt works, even after the recording staff and the conductor assured Richter that the First Concerto was "in the can," the pianist insisted on performing another complete take, having renewed his energies with extra quantities of sugar cubes and bitter chocolate squares. And, to everyone's amazement, he surpassed all his previous takes.

Fig. 2. Richter and Rostropovitch listen to playbacks. (Photo by Harold Lawrence.)

In most performances of the Liszt concertos, the brilliant, flamboyant side of the music is stressed. Richter's interpretation runs counter to this tradition, containing more fire than fireworks. Nothing is lacking in terms of virtuosity, as the opening octaves of the First Concerto instantly demonstrate, but rarely does one encounter such sensitive delineation of the lyrical elements of these Romantic works. The beginning of the second movement of the E Flat Concerto is a case in point. This nocturne-like melody, in Richter's hands, moves from one dynamic plane to the next with exquisite control, lingering almost imperceptibly on certain notes in order

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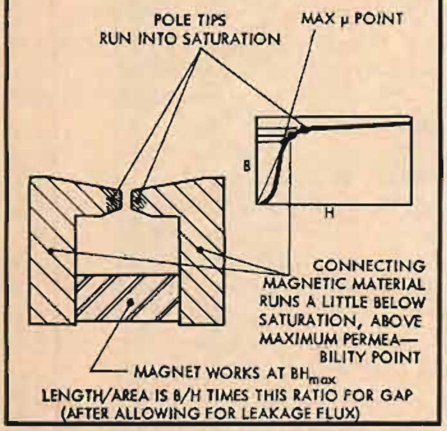
to mold the contour of a phrase, soaring to an appassionato climax in ringing octaves, and finally cascading down to the level of a whisper. (How often have we heard pianists treat this descent like a toboggan chute!)

Following the concerto sessions, Kondrashin flew back to Moscow, and Richter remained in London to record Beethoven sonatas with his friend and chamber-music partner, Rostropovitch. The sessions took place in an atmosphere of high spirits, Richter relaxing after his Lisztian ordeal, and Rostropovitch still basking in the glow of his success in two orchestral concerts at the Royal Festival Hall. After the final take, Rostropovitch mysteriously asked Richter to play Chopin's F Minor Étude (opus 25, no. 2). Puzzled, the latter complied; and Rostropovitch gleefully superimposed the tune, *Dark Eyes* (Ochi Tchornya), above the Étude, making a perfect quodlibet. Too bad the tape machines had stopped rolling. Æ

LOUDSPEAKER MAGNETS

(*from page 48*)

V is already achieving a good degree of saturation at the pole faces, substituting the new materials will not increase density in the gap materially—merely increase leakage flux, which is not needed (*Fig.* 5). Another alternative would be to beef up the pole faces so a greater excursion could be handled without distortion. Using this method will upgrade the power rating of the unit. Usually an initial design is thoroughly worked out. But too often, at a later stage, it is found advisable to increase clearances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H
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MAGNET WORKS AT BH_{max}
LENGTH/AREA IS B/H TIMES THIS RATIO FOR GAP (AFTER ALLOWING FOR LEAKAGE FLUX)

Fig. 7. A magnetic circuit schematic showing the relevant densities at which different parts of the circuit should be operated, according to design. The calculations must take into account total flux and total cross-sectional area of the magnetic circuit at each point, and must allow for leakage flux.

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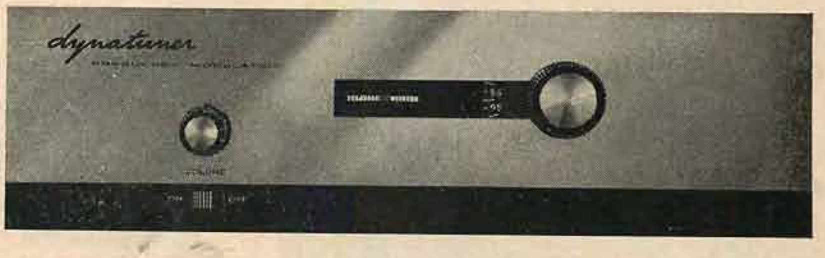

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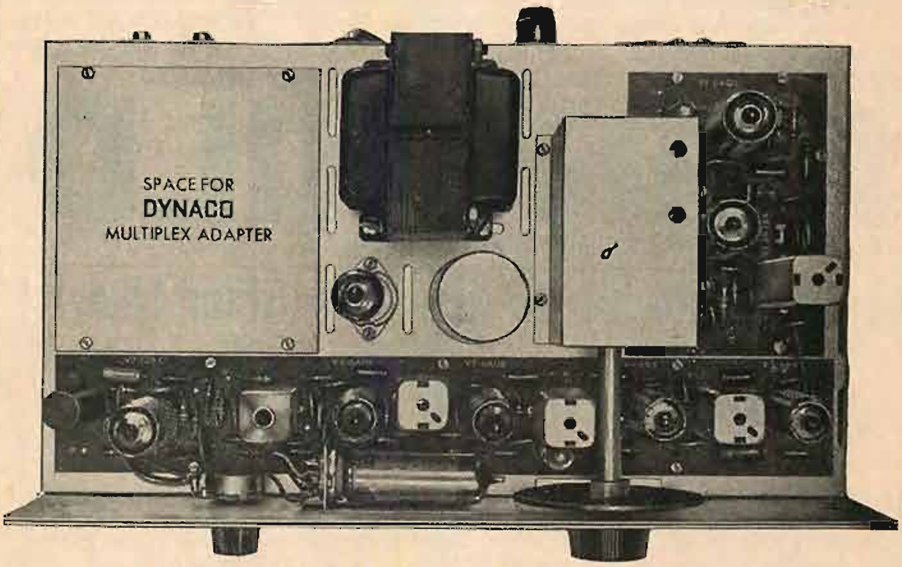

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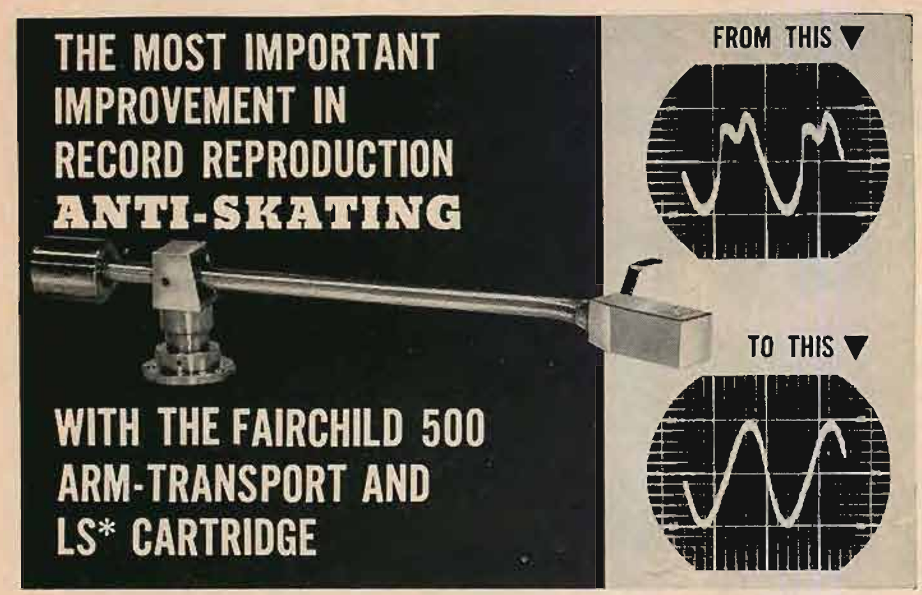

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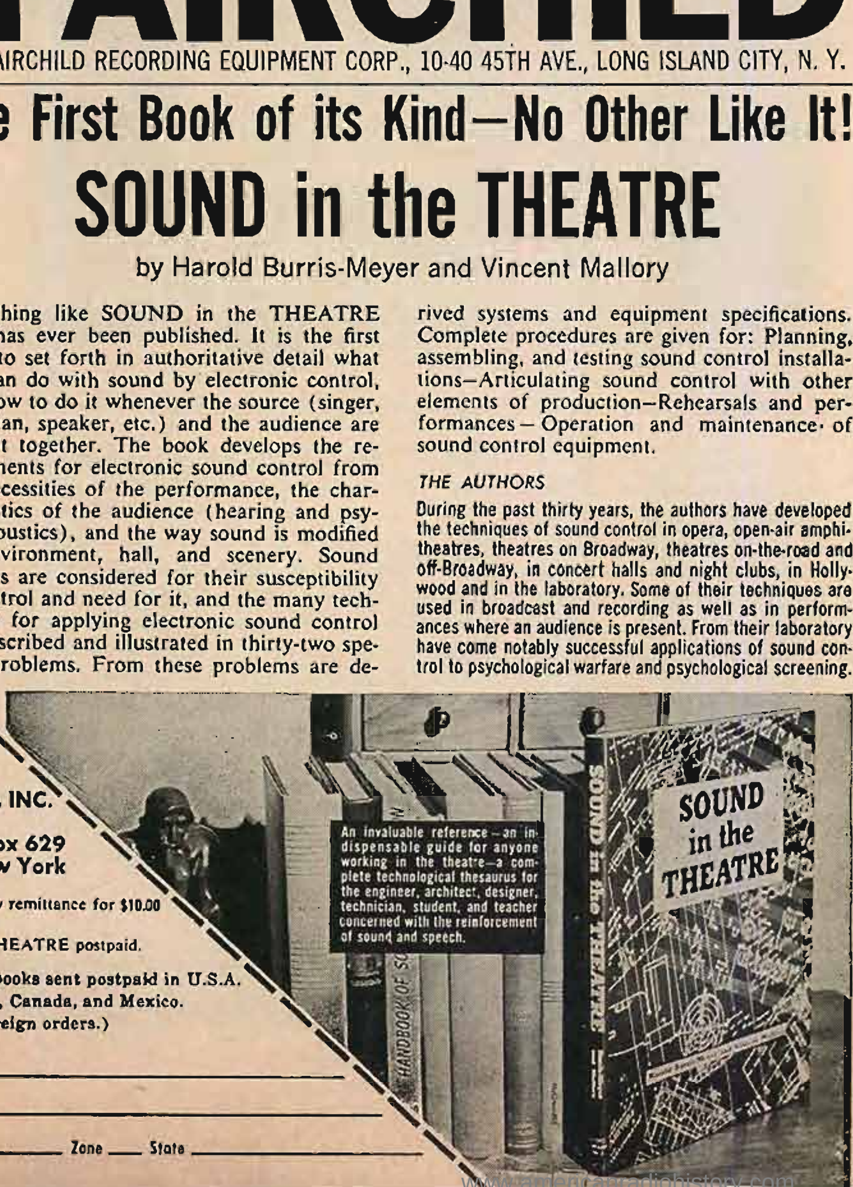

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in the gap. This is done, and the magnet design not changed, with the shrug "It's probably adequate."

Opening up the gap not only increases the amount of gap that has to be filled with field, it produces a mismatch (assuming the original design was a match) between magnet and gap and also increases the leakage loss. So what may appear an infinitesimal increase in clearance may result in much-larger-than-expected loss of magnetic field. This is why manufacturers of the best loudspeakers prefer to tighten their assembly techniques and/or quality control, so the narrower gap can be used.

A good question that arises when you design a new loudspeaker is "ring magnet or slug"? This can only be answered for individual cases. In general a slug has the advantage of less outside leakage, because the return path is of a non-active magnetic material. But this does not necessarily mean the magnet itself has less leakage (*Fig.* 6).

The only way to answer the question is to figure out magnet dimensions of both types to supply the required field, with a suitable margin for leakage, according to shape, and complete the design for return path and pole faces, making sure that the major part of the return path is not saturated but that the pole faces are (*Fig.* 7). At this stage it will usually become evident that one or other configuration is more suitable from a practical construction viewpoint. Æ

ONE STEP

(*from page 54*)

ness transacted with Clarence and alert to the possibly lucrative future, salesman Slater arranged a generous trade-in allowance for Clarence's old speaker system. It nearly paid for the new electronic crossover and power amplifier to go with the three-way speaker system that Clarence purchased.

The new speaker made Clarence happy. He spent days and nights playing his records and finding fresh delights in each disc. Now, he was almost sure, his audio system was beyond reproach. To be completely sure, he invited Marcel Pré to listen to it. Marcel had initiated both Harold Detwiler and Victor Berlioz to hi-fi. Marcel was a pro's pro.

"Your system is admirable," Marcel said. "But tell me the truth, isn't it like ten people in a telephone both? Too much in too little space. You need stereo to spread the sound, give it depth, separate the instruments from each other, impart a sense of direction. You understand?"

"You mean I need two channels, two of everything."

"You understand," Marcel said. "You have excellent power amplifiers and a marvelous speaker for one channel. Get the same for the second channel. Get a stereo amplifier in place of your present one. You should buy a stereo preamplifier with a center channel output. Then you will need a third power amplifier, a third set of electronic crossovers, and a third speaker system. That can't be helped, but the results will be exquisite. For stereo you will require a new tone arm and a new cartridge. Your tape recorder. And buy a multiplex and amplification for the second channel. For you it will be simpler to buy a new tape recorder. And by a multiplex adapter so that you can receive stereo from a single FM station."

All this was soon done, and the results were beyond Clarence's expectations. In the following weeks many came to hear Clarence's hi-fi system. Everyone approved, most marveled, and no one ventured suggestions for improvement. As time went on, though, Clarence found his enthusiasm waning, because now all there was to do was listen. The excitement of buying, changing, adding was past.

Then one night Marcel Pré brought along Ed Williams. "Ed is an electronics engineer and very much interested in audio," Marcel said to Clarence. "How do you like *this* hi-fi system?" Marcel asked Ed.

"Wonderful, wonderful," said Ed. "This is a wonderful beginning."

"Beginning!" exclaimed Clarence.

"Don't misunderstand me," Ed continued. "Of course you have a wonderful system, certainly one of the best I know of. That's what makes it a pity to stop at this point. Why not make your system the best of all?"

"What more is there to do?"

"What more, he asks," Ed said to Marcel Pré. He turned back to Clarence. "Have you heard of three-channel tape machines? We can install one here. I can get three-channel tapes for you. Then you would have a true center, not merely a blend of the left and right channels. Good?"

"Sounds good," Clarence agreed.

"That is not all."

"Not all?"

"Far from it. We can make tests of your living room to determine if you have the proper reverberation period for a room of this size. Too little reverberation and the music is dead. Too much and it gives you a headache. Based on the measurements, we can place suitable acoustic materials on the walls and ceiling to achieve the correct reverberation period.

"Using calibrated microphones, we can take acoustic frequency measurements in the area where you and others generally sit when listening to your system. Undoubtedly we would find peaks at certain frequencies and dips at others. Then we could construct special electronic filters, to be inserted between the preamplifiers and the electronic crossovers, which would smooth out these peaks and dips. I wouldn't be surprised if we achieved acoustic response flat within a decibel or two over the entire audio range. Do you like that?"

"I like it," Clarence said. "I guess that would really wrap it up."

"Clarence, when I say the best I mean the best, for now and for some time in the future. Hear me out.

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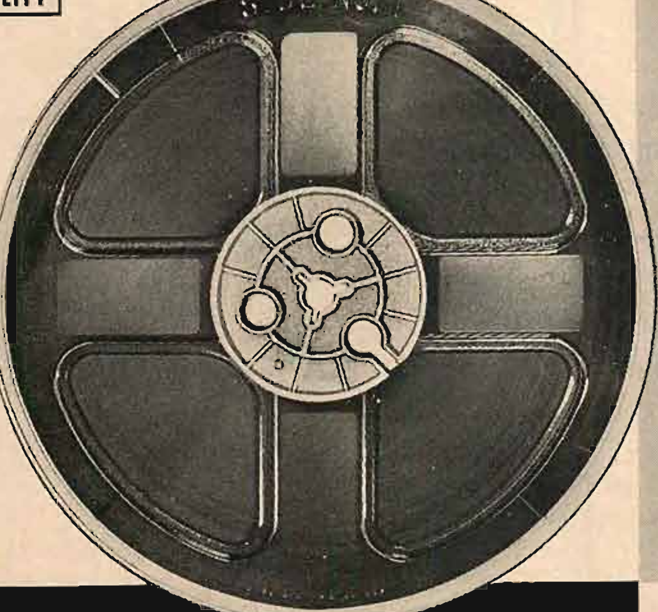

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"We can add extension speakers in your other rooms, together with remote controls so that you could operate your system, or at least the principal functions, from any place in your apartment.

"We can install a color organ, so that at the touch of a button lights would flash and dance in many colors in a visual representation of the music.

"We can. . . ."

"Wait," Clarence interrupted. "Let us take this one step at a time. If you could write that down. . . ." Æ

RECORD REVUE

(*from page 69*)

the resulting discs, each a bit hi-er in the fi than the last, continue to portray the unique style of this greatest of present performers on the instrument. He is still musically in his in his prime (though I bought 78-rpm records of his playing back in the early Thirties) and he still puts over the same familiar sort of program, complete with a very generous sprinkling of works dedicated to the great man himself. It's getting so about half the guitar literature is dedicated to Segovia these days.

Nobody-but-nobody can play like him, but few desire to, in any literal way. The Segovia touch is, of course, old fashioned, a Romantic-Impressionist approach to guitar music, full of delicate colorings, slidings, hesitations. *He* can do it; but nobody any younger can really get away with it. So the legion of Segovia followers is a tribe of sober, plodding realists in comparison, according to the new literal-minded ways of thinking.

This disc, as usual, starts with some "ancient" music—this goes back merely to the early Eighteenth century—and then launches into the inevitable Fernando Sor, the Paganini of the guitar (*not* the Beethoven, as the notes say he has been called!), glib, tuneful, slightly tiresome after awhile with his Beethoven-period brightness. Then on we go into the dedicated works—a long "Homage to Boccherini" for guitar (B. was an Italian who worked in Spain in Mozart's day) by that oddly named composer Mario Castlenuovo-Tedesco, which presumably means, in Italian, the new German castle. From there to a slithery pseudo-modern bit by one Rodrigo (dedicated to Segovia in 1954) and then, on side 2, back to the Seventeenth Century (Roncalli) and, again—more Sor. The end-piece, out of all this stuff, is the only one that really got me more than mildly interested—a superb guitar arrangement of the Spanish Dance No. 10 of Granados, originally for a guitar-imitating piano.

Every guitarist and guitar-lover *must* study Segovia in detail and at length. But that doesn't mean we can't be mildly exasperated at the stuff he plays.

Chopin: 12 Polonaises. Grant Johannesen, piano.

Vox VUX 2003 (2)

One of Vox's new smaller "boxes"—two-disc and in a soft cover—this offers grateful and musical readings of the big Chopin pieces by one of the rare natural Romantics of the pianist generation now in middle age —most of them tended towards the hard, trip-hammer banging approach. (The new young pianists are suddenly Romantic all over the place.)

Johannesen is a solid, honest sort of player with a fine ear and plenty of nuance; he does not bang, yet he plays forcefully even so. But this is not the ultra-showy brilliant Chopin of such as Rubinstein; it is milder, more thoughtful, of a somewhat Brahmsian cast. True, Brahms came long after Chopin and you might say this is anachronism; but remember that Chopin lives on into each new era in a new form. It is surely as right to interpret him in a Brahms style as to perfume him with French selfconsciousness as was once done by the great Alfred Cortot. I'd say that this is Chopin for everybody, especially easy in its sheer musical communication. Æ

STEREO SWITCHING

(from page 52)

lent circuit for channels 1 and 2 is given in *Fig.* 5. The same 525-ohm series resistors are employed. But now a shunt resistor of 375 ohms is switched in. The impedance seen by each attenuator, which in this case is 615 ohms, and the load presented to the amplifier input, now 187 ohms, may be found as explained in the preceding examples. Mixing loss will be about 15.3 db.

In the stereo center leg (*Fig.* 6) a 120-ohm shunt resistor and 51-ohm series resistor are in the circuit. Now, R_5 and R_{13} in series are in parallel with R_{20} which in turn is in parallel with the series combination of R_{21} and the stereo center amplifier input R_{22}. Each input attenuator, R_{12} and R_{13}, will therefore look into 595 ohms and the amplifier input will see 150 ohms. Mixing loss is 17 db.

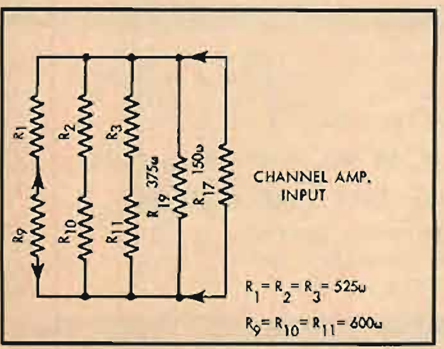

Fig. 5. Equivalent circuit of mixing-matching network of **Fig. 2** in the stereophonic plus center mode. Only one channel is shown.

Attenuators and amplifiers with other impedance values may be used and the mixing-matching resistors adjusted accordingly. A 150-ohm amplifier input impedance gives a greater signal step up than a 600-ohm input which offsets some of the mixing loss. This will be so when an amplifier has both input impedances.

Note that two resistors are not standard values. These are values that worked out best mathematically. They may be obtained by shunt or series combinations, but for all practical purposes the nearest RETMA values will serve. Also, there will be some variation from the mathematical figures given for impedance and loss values due to tolerance of the component parts used. As an example, actual measurements of loss for the three modes of operation varied from 18 to 19.5 db, a variation of just 1.5 db.

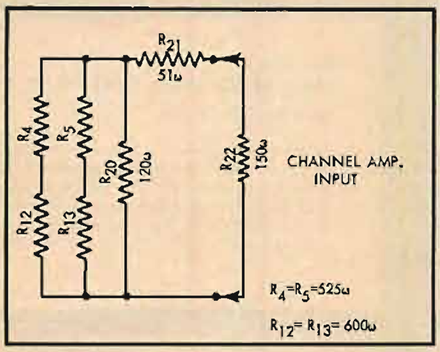

Fig. 6. Equivalent circuit for the center channel when operating stereophonic plus center. See text.

This mixing, matching, switching arrangement which, of course, can be set up for other input combinations, is simple, causes minimum losses, provides uniform signal levels, uses a minimum number of parts and gives satisfactory impedance matches in all directions for the three modes of operation. Æ

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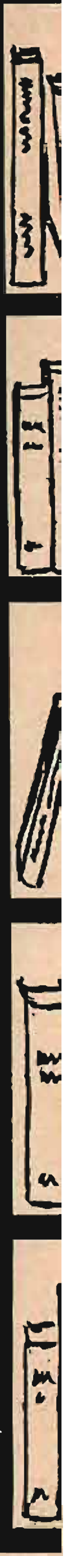

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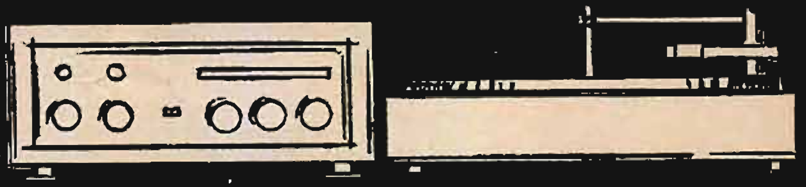

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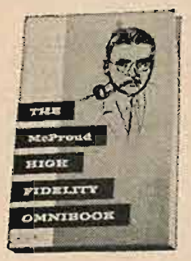

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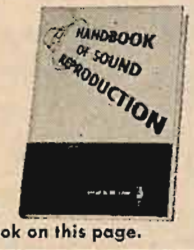

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MULTIPLE SPEAKERS

(from page 37)

of the systems described. However, a good indication of the relative degree of this type of distortion present can be obtained from a consideration of the amplitude of cone movement and linearity of each.

The poorest performer will be the six-inch loudspeaker. Because it is the smallest, it will have the greatest excursion. Since it reproduces all the frequencies with a single cone, it will have the greatest tendency to produce FM distortion. The non-linear suspension coupled with the large excursion will result in it having the greatest IM distortion.

The array should produce very little FM distortion if any because, the excursion of the speakers is very small. The IM distortion should be also less because of the small excursion and, therefore, more linear operation. The IM should be further reduced for the closed back case because the suspension non-linearities are still further reduced.

Although the woofer excursion of the TF-3 is considerably greater than that of the array, FM distortion will not be troublesome because the higher frequencies are being reproduced by separate speakers. The IM distortion characteristics should be at least as good as those of the array (and possibly better) because of the extremely linear cone suspension.

Important efficiency gains of 3 db for each doubling of speaker complement can be obtained from an array. These gains do not, however, occur in the 20 to 50 cps region. Maximum efficiency occurs above 100 cps.

Advantage can be taken of the efficiency improvement by using no more than four or six *good quality* eight-inch or larger speakers. Because the directional patterns of the array are very poor, the use of a mid-channel/tweeter combination crossing over at about 400 cps is recommended. A "curved front" cabinet is recommended if full-range speakers are used.

The approach of using an array of inexpensive replacement type speakers for high-fidelity applications is definitely not recommended. The small amount of distortion and high efficiency are of doubtful value when the equally important characteristics of narrow bandwidth, irregular response, poor transient response, and extremely "sharp" directional patterns are considered.

The idea that this approach will "save money" is a myth. Many fine high-fidelity speaker systems with better performance capabilities are now available in lower price ranges. An important advantage is that these commercial systems are much smaller. For example, compare 1.5 cubic feet to 8, or 3 cubic feet to 16 in the case of a stereo installation.

The psychoacoustic factors involved in the reproduction of music are very complex. The order in which a number of listeners will rank several identical loudspeakers will vary appreciably. They will prefer the loudest of the two speakers because "it sounds better" even though the opposite may be true. Leo L. Beranek has stated that a person who selects his own components and builds his own cabinet will usually prefer his own loudspeaker to any one elses if he is convinced that he has made a wise choice of design.

The writer cannot recommend a single change to those readers who are completely satisfied with arrays they may have constructed. To those who may be contemplating the construction of an array of small speakers, the expenditure of a few hours of time is recommended in listening to some of the small high-quality speaker systems available commercially. The performance, price, and size of these should be weighed against those of the array. Æ

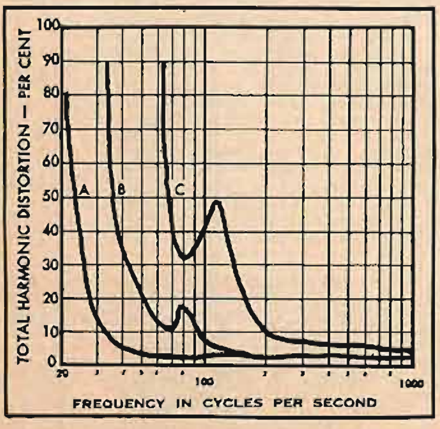

Fig. 9. Total harmonic distortion curves for array of 32 6-in. speakers, (A) and (B), and for a single 6-in. speaker in an open back cabinet, (C).

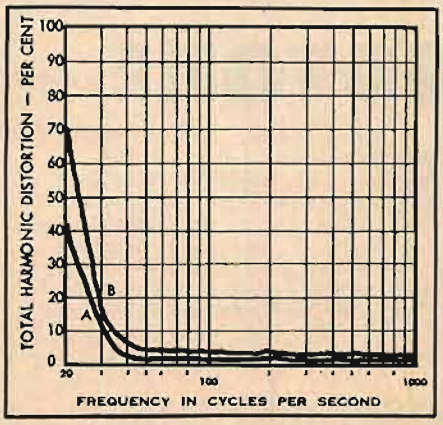

Fig. 10. Total harmonic distortion curves for 3-way speaker system, Jensen TF-3, at 5 watts (A), and at 20 watts, (B).

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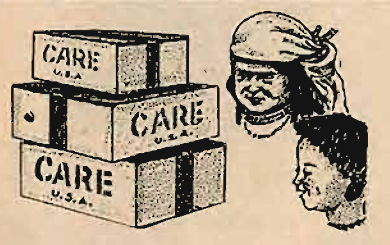
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LIGHT LISTENING

(from page 10)

show tunes of Broadway. Being a Ros production, it manages to turn up a session with a difference. All twelve tunes, even ultra standards such as "People Will Say We're in Love" and "I Could Have Danced All Night" have been embellished with Latin dance rhythms. One has a choice of Merengue or Cha Cha. Prominent in the album box is a leaflet containing the lyrics of most of the songs for the benefit of the listener who may elect to throw himself into this thing with full abandon. The tartness of flavor injected by the energetically played and closely-miked Latin percussion may prove to be a selling point for those who have grown tired of conventional frameworks for Broadway staples. On the other hand, prospective listeners who cherish preconceived ideas on how their favorite show music should be handled are advised to approach this release with some caution. Neither camp will have occasion to find fault with the definition or the vigor of the bass response in this reel.

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In this Webster Hall session for M-G-M the members of the band work in a standing position, an Elgart practice that helps to get the sound of the instruments out from under the music stands. The master tape of this release may be fine but I still prefer the pressings Columbia gave Larry in 1958. It seems a pity to have all that scrupulous work go into the production of the M-G-M tape and then end up with a disc of scarcely average cleanness in the upper frequencies. Equally depressing is the realization that, as the work of Larry Elgart's arrangers grows in maturity, the commercial appeal of the band still isn't enough to keep it on the bigger labels. If you enjoy the uncommon tunes of the past (Get Out of Town, Tony's Wife, I've Got You Under My Skin) you'll want these arrangements by a painstaking band. Æ

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• **Audio Devices Opens Washington Sales Office. George R. Freifeld** has been named Mid-Atlantic Sales Manager of the new Washington sales offices of **Audio Devices, Inc.** in Silver Spring, Maryland. The new sales office has been opened to facilitate sales of computer and other tapes in this territory, and in particular to handle the increased government demands for these products. Mr. Freifeld has been with Audio Devices as Sales Representative since 1953. Assisting Mr. Freifeld are **Andrew Rice** for Washington and Baltimore, and **Albert Rader,** who will cover the Philadelphia area. The Washington office will service the Mid-Atlantic States, including Delaware, Maryland, District of Columbia, Southern New Jersey, and Eastern Pennsylvania.

• **Klipsch Appoints Salesman.** Klipsch and Associates announce the appointment of **R. L. (Bob) Moers** to its sales staff. Previously Moers was associated with Sunbeam Corporation and the Marine Products Division of McCulloch Corp. where he was District Sales Representative. He is a native of Chicago and a graduate of the University of Illinois.

• **Ampex Corporation Appoints President. William E. Roberts,** formerly Executive Vice-President of Bell & Howell Company, has been named President and Chief Executive Officer of Ampex Corporation, succeeding **George I. Long, Jr.,** who will resign the top management post, but will continue as a director. The change was effective August 1, 1961. In addition to his top management post with Bell & Howell, Mr. Roberts was Chairman of the Board of Consolidated Systems Corporation, a partially owned subsidiary engaged in development of electronic systems controls for industry, and was Chairman of the Executive Committee of Consolidated Electro-Dynamics Corporation, a wholly owned subsidiary manufacturing electronic instruments for military, missile, space, and commercial applications.

• **American Concertone Appoints. Paul Abbey,** former Regional Sales Manager of Ampex Professional Products, has been appointed Director of Marketing, Consumer/Professional Products of American Concertone, Inc., a division of Astro-Science Corporation. **Melvin C. Oelrich,** President of American Concertone, in making the announcement stated that current sales are over 30 per cent ahead of 1960, and that the addition of Mr. Abbey will result in a still greater increase in the coming year.

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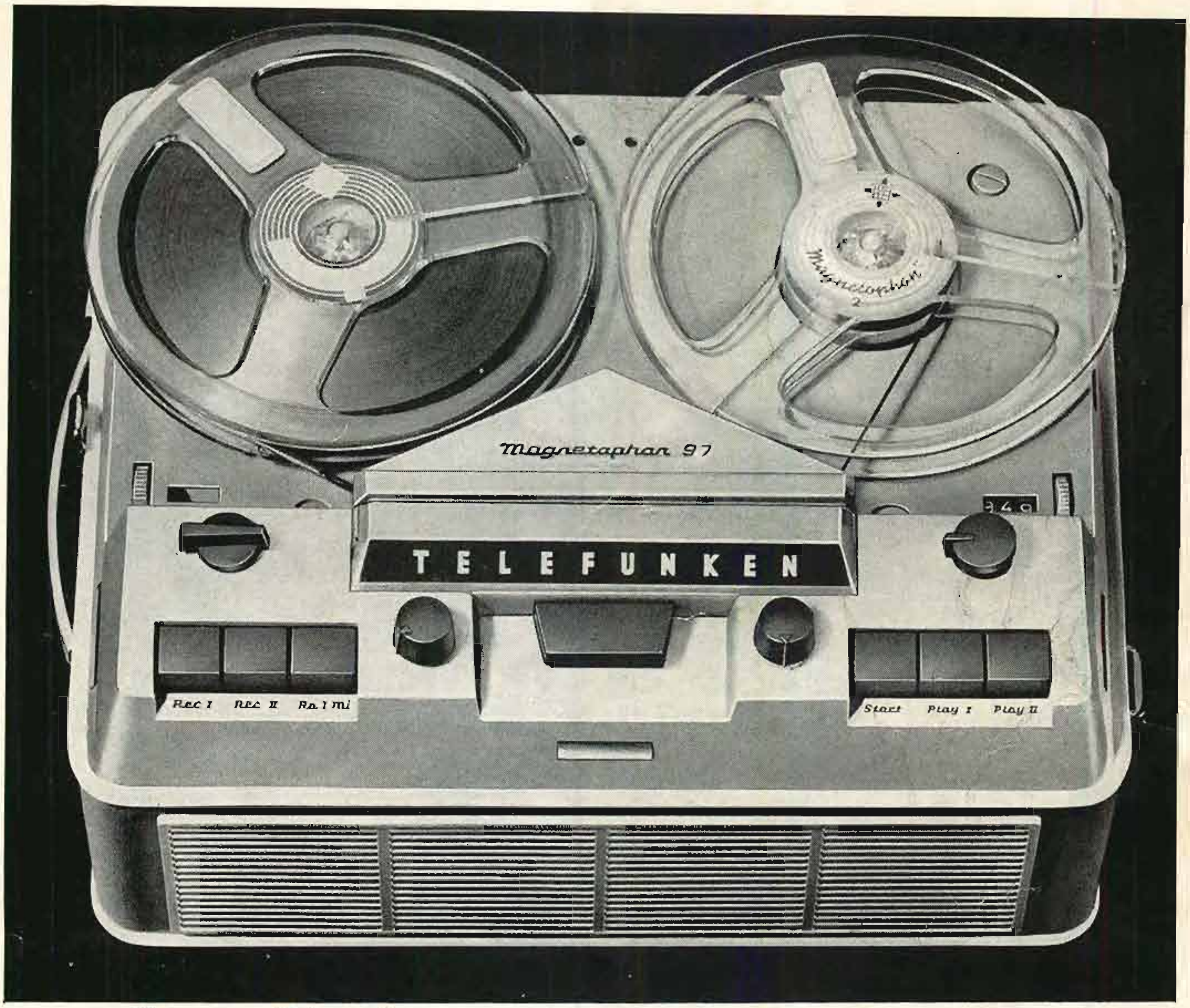

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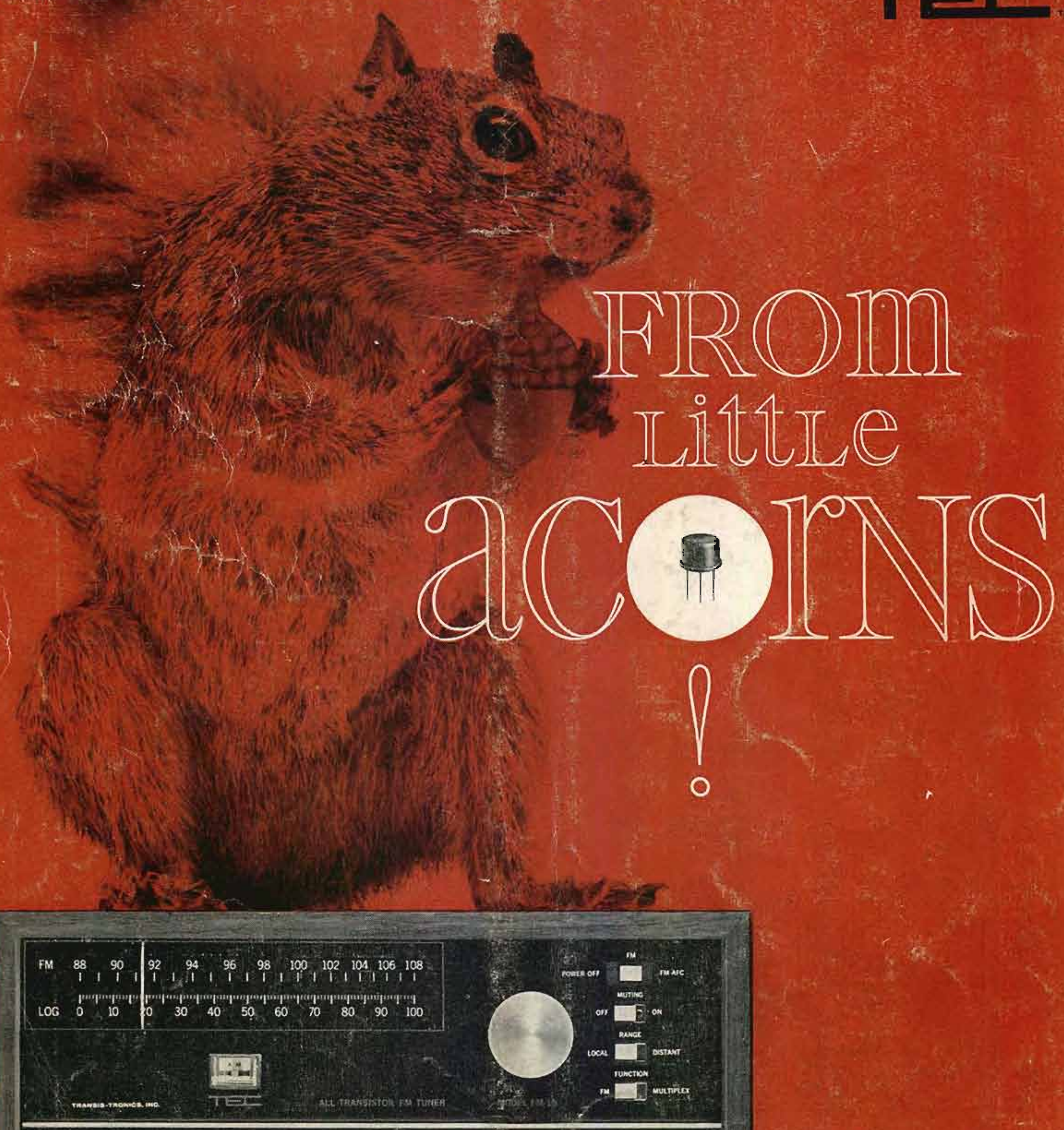

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